# EDITORIAL

THERE has been little change in the general TV position during the past few months. Stations are settling to a steady routine, featured shows have filtered down to their set positions, and in this connection we see a marked similarity to the program building technique already familiar in broadcasting.

Set sales continue to be steady. Recovery from the slump earlier in the year has been maintained, but there are no signs of either a sudden boom in licences or a noticeable lapse.

Business has been better than some people expected but not as good as the most optimistic estimates which were given by others. I cannot see how this position is likely to alter for some time, unless a co-ordinated move is made, particularly on the program side, to encourage a boom.

And this might be a very good thing to get under way later in the year. A six weeks' intensive effort by the entire industry might produce extremely valuable results. It is dangerous to stand still too long in the TV world. Old faces and long repeated sessions can become intolerably boring almost overnight, and already there are many people ready to spread the gospel that the TV programs are not worth the price of a set.

Radio set manufacturers can, I think, expect little immediate impact on their receiver sales, but it would be foolish not to realise that, when enough TV sets are in operation, few people will forsake the screen for the loudspeaker.

Fortunately, the radiogram and record world are proceeding from strength to strength.

Australia has proved an immense field for gramophone records, and overseas people just can't understand how we absorb them all.

For instance, recent estimates show that, whereas America consumes something like 130 million discs per year for nearly 200 million population, Australia is expected to get through 10 million records in the next 12 months with a population not exceeding 10-million.

And there doesn't seem to be an end in sight. From our point of view, more and more home constructors are making up hi-fi amplifiers, or buying them, and every new owner spreads the gospel of sound.

Not only in numbers are we fortunate, but also in quality and quantity. There is nothing wrong with the standard of pressings which come to me every week, and practically every worthwhile disc released in the world finds its way into catalogues.

There may be a very gratifying moral in all this. I'll leave it to you to work it out for yourself.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

**EDITOR**
JOHN MOYLE
S.M.I.R.E. (Aust.)

**TECHNICAL EDITOR**
NEVILLE WILLIAMS
M.I.R.E. (Aust.)

MAURICE FINDLAY
A.S.T.C.

PHILIP WATSON
M.I.R.E. (Aust.)

W. YASHIN

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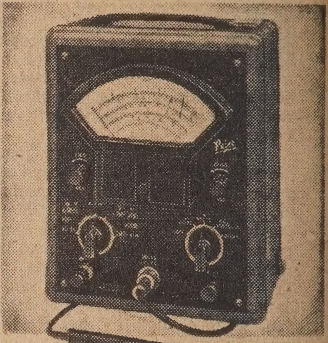

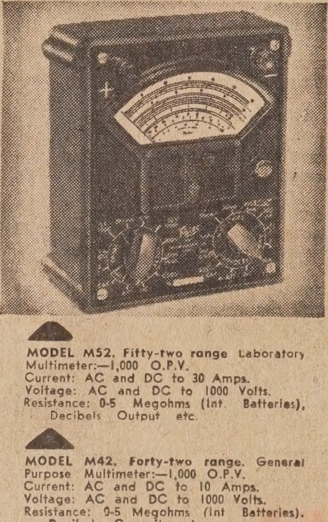

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| TVP | High Voltage DC Probe to extend range of TVM to 30,000 Volts | £9 10 0 |
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| MX47 | Multimeter (20,000 Ohms/Volt) | £39 15 0 |
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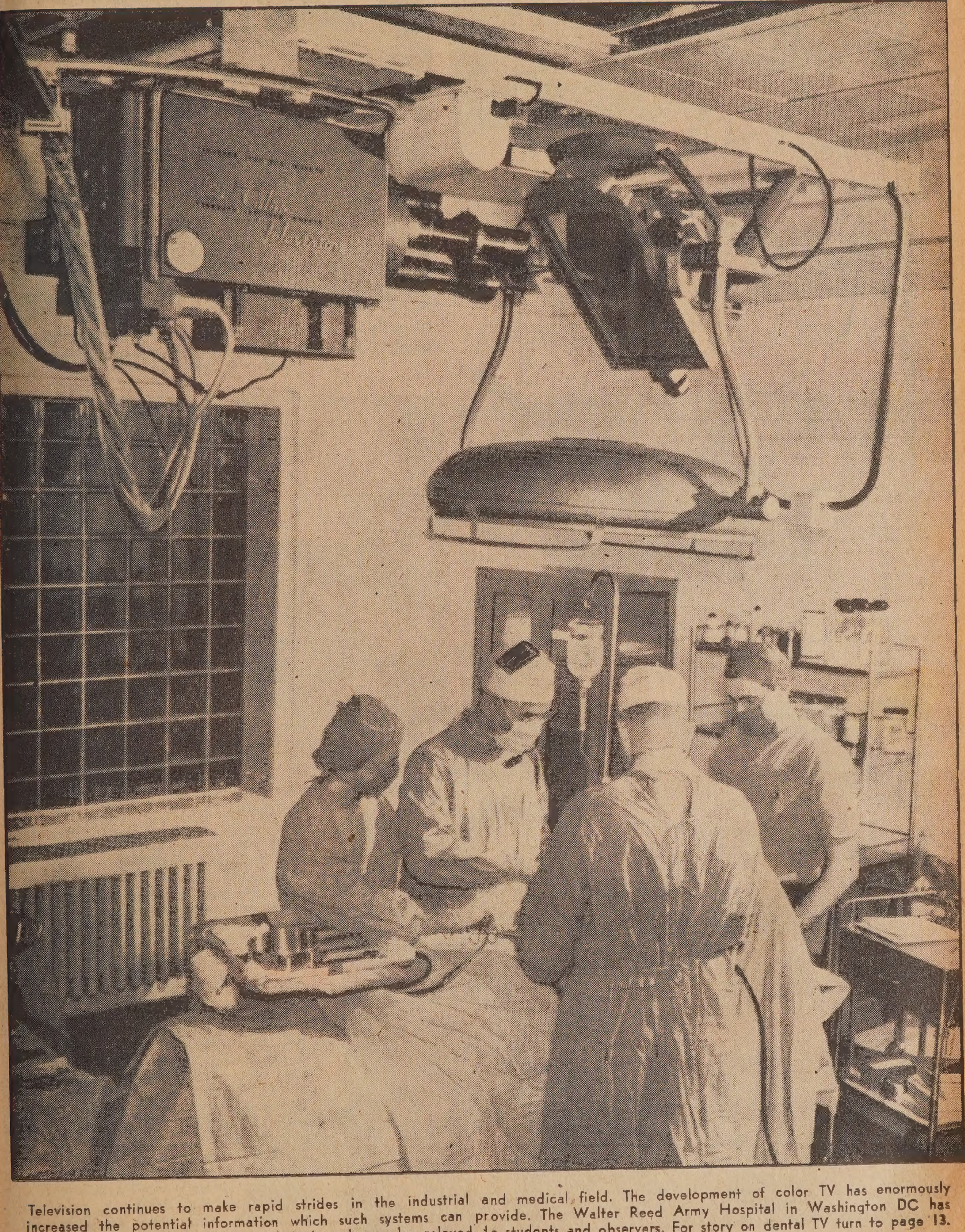
# SURGEONS TEACH WITH COLOUR TV

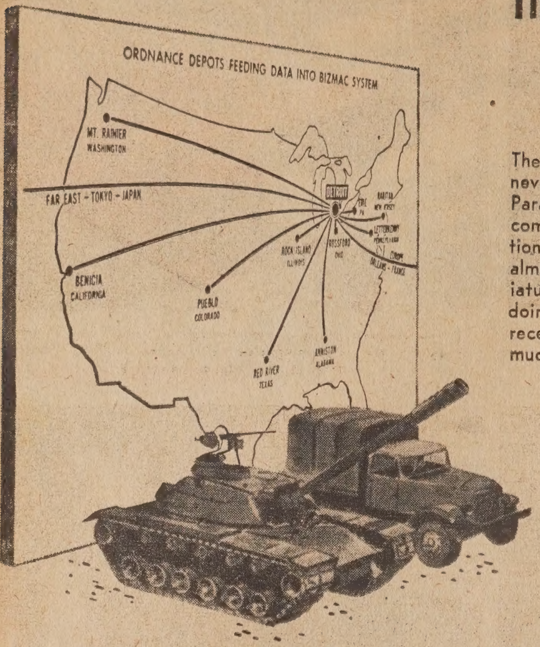


Television continues to make rapid strides in the industrial and medical field. The development of color TV has enormously increased the potential information which such systems can provide. The Walter Reed Army Hospital in Washington DC has installed this equipment so that surgical work can be relayed to students and observers. For story on dental TV turn to page 13.

# MINIATURE PARTS MADE BIZMAC

# The World's Largest Electronic Brain

The march of electronics, varied in its many phases nevertheless is a tightly co-ordinated movement. Paradoxically enough, the development of smaller components has allowed the design and construction of mammoth devices which would have been almost unworkable without the compactness of miniaturisation and the introduction of simpler ways of doing things. Thus this huge electronic "brain," recently demonstrated by R.C.A. of America, owes much of its success to the ingenious use of little things.



1. Information on more than 170,000 separate tank and automotive spare parts is fed into the Bizmac system daily from depots shown on the map.

2. The information comes in on punched cards and is transferred to magnetic tape. Each reel, above, holds as much information as ten file shelves.

KNOWN as Bizmac, and claimed to be the largest calculator of its type in the world, it was recently demonstrated in public for the first time, when the U.S. Army Ordnance Corps looked it over.

This Corps is one of the largest handlers of materials in existence, and the paper work necessary to keep tag of its great stores is an enormous item in administration and man power.

Not only is accuracy and capacity required, but speed in extracting information is vital in an organisation dealing with defence. Time is often the controlling factor in determining the practicability and planning of operations.

Bizmac, which cost more than 4m dollars, is installed at the Army Ordnance Tank-Automotive Command headquarters in Detroit, where it has reduced months of paper work to minutes of push-button operation. Incidentally it is expected to save the Army many times its cost apart from its other advantages.

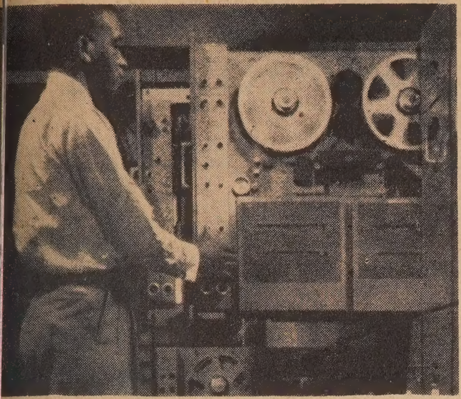
It keeps track of more than 100m facts about the Army's vast inventory of tank and automotive spare parts throughout the world—everything from nuts and bolts to entire engines. Bizmac maintains up-to-the-minute information about what supplies are on hand, how fast they are being used, what has to be ordered and in what quantity.

## LIGHTNING SPEED

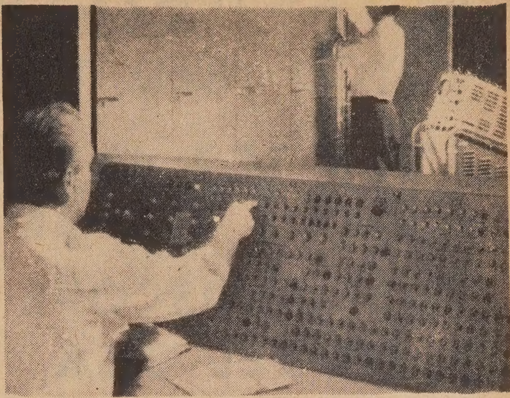
The Bizmac installation in Detroit includes some 220 units of 19 different but fully integrated types of equipment. It can handle more work than any other data processing system because of its ability to do a number of operations simultaneously and to control and coordinate them from a central point. The system can complete in 48 hours an inventory procedure that once took up to three months; process by computer in one hour as much work as 400 girls with hand-calculating machines could turn out in the same time; read from magnetic tape at 1,700 words per second—a rate at which it could finish Tolstoy's "War and Peace" in about five minutes.

The pictures shown here give some

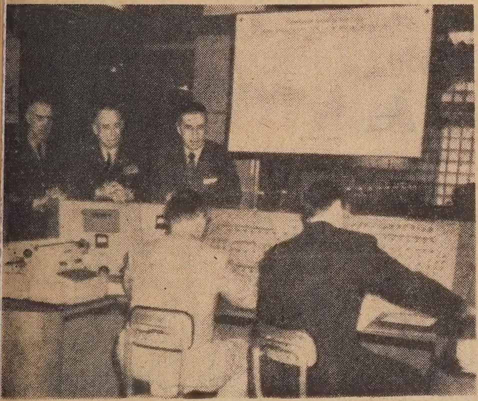
# STEPS IN THE OPERATION OF GIANT CALCULATOR



3. Some 182 Tape Stations, like the one above serve as basic storage medium. Each station can be connected to other units at the push of a button.

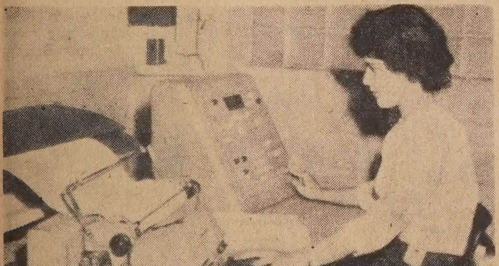


4. The magnetic tape is run through a Sorter, above, which does the electronic equivalent of "paper shuffling"—putting data in the proper sequence.

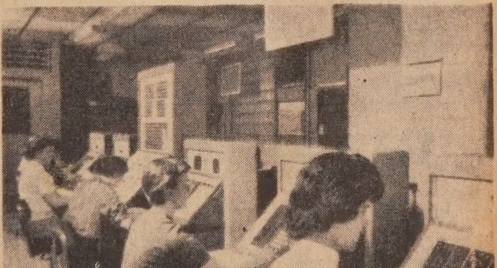


5. Tape is then processed through the Computer which automatically updates the files and singles out items for the attention of the supply manager.

6. When Computer finds a depot short of an item, it passes information on to Electro-Mechanical Printer which prints re-order form at 600 lines a minute.



7. If one particular fact is needed quickly, this Interrogation Unit can search system's entire 100 million facts and find the answer within three minutes.



8. All of Bizmac's 220 units can be operated by remote control from this room, known as System Central, which is similar to a telephone exchange.

# TV TECHNICIANS!!

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EQUIPMENT FOR INDUSTRY AND RESEARCH

idea of the steps required in operating the huge equipment and the comparatively few operators needed to handle such a large amount of information.

The trend toward miniaturisation has gone a lot further than the average consumer would imagine on the basis of the small radios and smaller hearing aids which he sees.

It is safe to say that much of the special electronic equipment, other than Bizmac, and including military weapons would be impossible without it. One cannot envisage such equipment performing sophisticated functions, at the same time being small enough to be toted around in the nose of a rocket, without extreme economy in space.

Here are some of the important R.C.A. developments in various fields made possible by the use of miniature components.

- An all-transistor voice-multiplexing system for military micro-wave radio communications that will be 90 per cent smaller and lighter than comparable conventional equipment and will consume 95 per cent less power. Scarcely larger than a 14in portable television receiver, it will weigh only about 85lb compared with 1100lb for conventional multiplexing systems.
- An ultra-miniature FM radio receiver that can be carried in a shirt pocket, yet is designed to provide extensions of several miles for radio systems now operating on the 150 megacycle band.
- A miniature magnetic memory unit for electronic computers, capable of storing 1m bits of information in a space little larger than a shoe-box, and of relinquishing any or all of the items in a few millionths of a second.
- A complete television station, including 4lb camera and 15lb back-pack transmitter than can be handily carried by one man and transmits television signals up to a mile to a receiving point for rebroadcast.
- A midget power supply unit for television studio equipment, reducing tube and space requirements by more than 70 per cent, permitting the power needs of a colour TV camera chain to be handled with two small units instead of a full rack of power supplies.

## FOR THE CONSUMER MARKET

These highlights typify developments occurring on a wide scale in military, industrial and commercial electronics to meet the continuing demand for compact, rugged and economical equipment. It is logical to expect that further advances in miniaturisation will have an increasing effect in the consumer field as well.

Soldier-scout sends live video pictures to his Command Post with eight-pound TV camera built to Army Signal Corps specifications.

Engineer examines some ultra-miniature transceivers and receivers for commercial and military use, in comparison with a standard U.S. Army helmet in the background.

In addition to the familiar examples of transistorised radios and subminiature hearing aids, there have been subtle changes inside many of the electronic items in the consumer market as a result of miniaturisation in components.

Printed circuits, for example, are finding their way increasingly into radios, television sets and phonographs. Printed on a flat board into which components are inserted, these elements not only save considerable space, but they lend themselves easily to high-speed automatic production techniques that help to lower cost and price.

Then, too, the pocket-size transistorised radio has achieved Lilliputian proportions with the added help of new miniature loudspeakers made possible by improved magnetic materials and design ingenuity.

## BREAK-THROUGH IN RESEARCH

Electronic miniaturisation, with all that it implies in new or improved performance and economy, is the direct result of a massive break-through in research during the past two decades. The essence of this break-through is the discovery that, electronically speaking, we have been doing things the hard way.

The operation of every electronic device calls for a supply of electrons whose actions can be controlled in various ways to perform such tasks as amplifying an electrical signal, oscillating to produce radio waves, or sensing and reacting to heat, light or pressure. The electronics industry, until recently, performed its wonders chiefly with supplies of free electrons laboriously "boiled" out of a heated filament in the vacuum tube.

In this process, electric current is supplied in substantial amounts to heat and cathode to the point where its atoms vibrate with enough violence to knock loose a useful quantity of electrons at a useful rate. These emancipated electrons move through the vacuum to an anode, or collector. During their passage, they may be influenced by the charge on a metal grid interposed between the emitter and the collector.

A small effect, such as a little charge, applied to the electron stream at the grid, for example, will be amplified into a far greater effect when the electrons arrive at the collector. From the collector, they are directed through a variety of circuits to the particular job at hand.

This way of handling matters seemed eminently satisfactory until research workers, impelled by a desire for greater compactness and efficiency in electron devices, began exploring possible ways to employ electrons without all the work of expelling them from the cathode into a vacuum.

## GUIDES FROM THE PAST

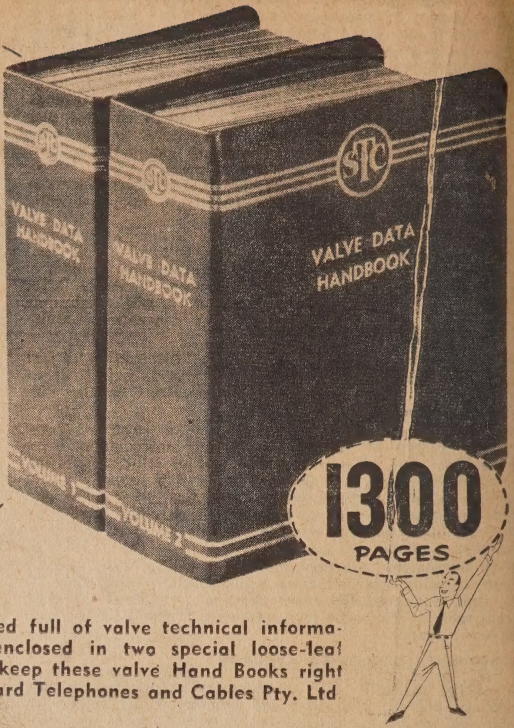
For the electronic scientists, there were some guides from the past—notably the use in early radio equipment of certain natural crystals, such as galena, which detected radio signals. The phenomenon was not, however, thoroughly understood at the time. The intensified studies led to greater understanding, and finally to a picture something like this:

The atoms of a crystal are arranged neatly in rows, like trees in an orchard, facilitating the movement of electrons through the material. In certain types of crystals possessing the right environment, it is possible to cause a movement of electrons from one extremity to the other by the application of a small amount of electrical or radiant energy.

(Continued on Page 79)

# AMAZING BOOK OFFER!

**VALVE REFERENCE LIBRARY 35/-**



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# RECORDER WEIGHS UNDER 2 LBS.

No doubt you've heard of miniature wire recorders, small enough to slip into coat pockets, powerful enough to record from 30 feet, compact enough to hold their own batteries and yet so versatile that they run for 2½ hours and feature all the advantages of normal tape recorders.

### By PEDR DAVIS

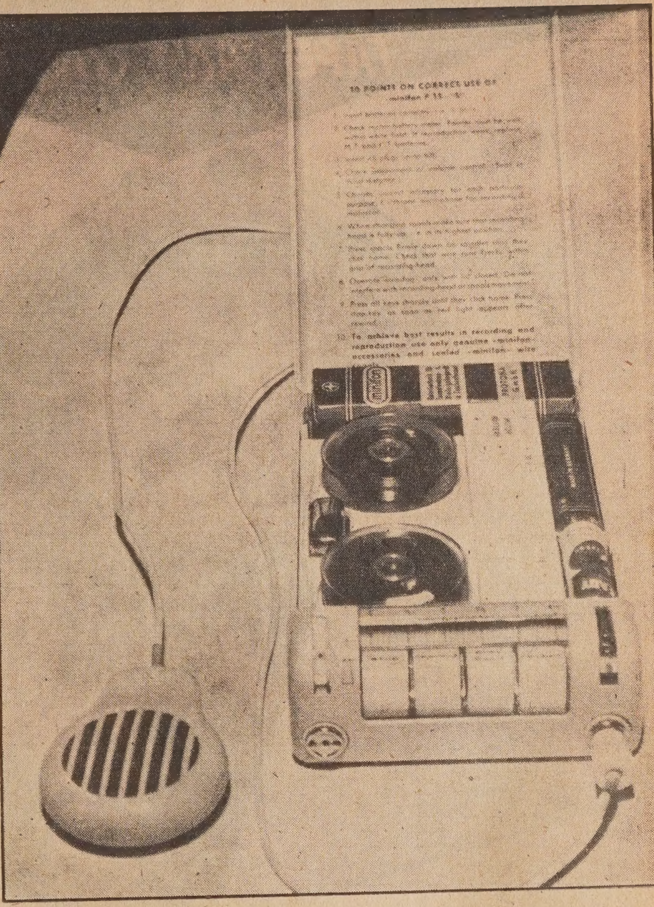
I HAVE one—a German Minifon and as a professional journalist, I find it as big an advance over the typewriter as a typewriter is over a fountain pen.

Fifty minutes ago the .002in wire spool was bare, now it carries a 3,000-word feature article, ready for transcription.

My use for this miniature recorder is purely as an office dictating machine but its astonishing versatility cannot go unmentioned. This pocket size recorder will:

- Record when connected directly to a radio or record player.
- Operate off the mains, self-contained batteries or car batteries.
- Play back through hand microphone, desk microphone or radio amplifier.
- Record two-way telephone conversations.
- Record surreptitiously through a dummy wrist watch microphone.
- Correct by over-speaking.

The entire unit and batteries is contained in a light alloy case no bigger than a box of 100 cigarettes. The controls are push-button, with STOP, REWIND and RECORD. A tiny hand crystal microphone both records and plays back. Its fidelity on the playback is marred slightly by background noise as the wire runs through the magnetic head, but the reproduction of either the stethoset headphones or transistor desk speaker is faultless. With the combined desk microphone and speaker, the volume possible is amazing.



(A) The complete Minifon tape recorder

## SELF-CONTAINED

As the photograph shows, the unit is equipped with self-contained batteries, though for normal office use, a small transformer/rectifier (adjustable for different voltages) takes the place of the costly motor battery.

The three batteries consist of a 30-volt anode "hearing aid" battery with a life of 150-200 hours, a 1.4-volt filament, lasting 20-30 hours, and a 12-volt motor battery with a 15-20 hour life. All cells are standard. In addition, there is a tiny battery meter built into the control panel of the recorder showing the condition of the motor battery.

The engineering of the Minifon is immaculate. All moving parts rotate in jewelled bearings and the operation of the motor is inaudible. The recording wire has an indefinite life and is available in different lengths (up to 2½ hours recording time). When the unit reaches the end of the spool, either on the record or playback position, the motor and main battery is automatically cut out and a pilot light signals a warning. These wire spools are readily interchangeable and should the wire snap (a rare occurrence) it can be joined with a simple knot, which passes easily and noiselessly through the magnetic head.

Like magnetic tape, the wire can be erased completely or corrections can be made simply by overspeaking.

There is also a cunningly devised indictator which shows at a glance how many minutes of recording are left on the spool.

Fortunately, surreptitious recordings are out of my line but in this field, the Minifon is without peer. The entire unit weighs only 1lb 11oz and slips into the pocket. The hand microphone can be hidden in the breast pocket of a suit and will record the two-way conversation competently. Alternatively, a highly sensitive microphone built into a dummy wristwatch can be had as an optional extra.

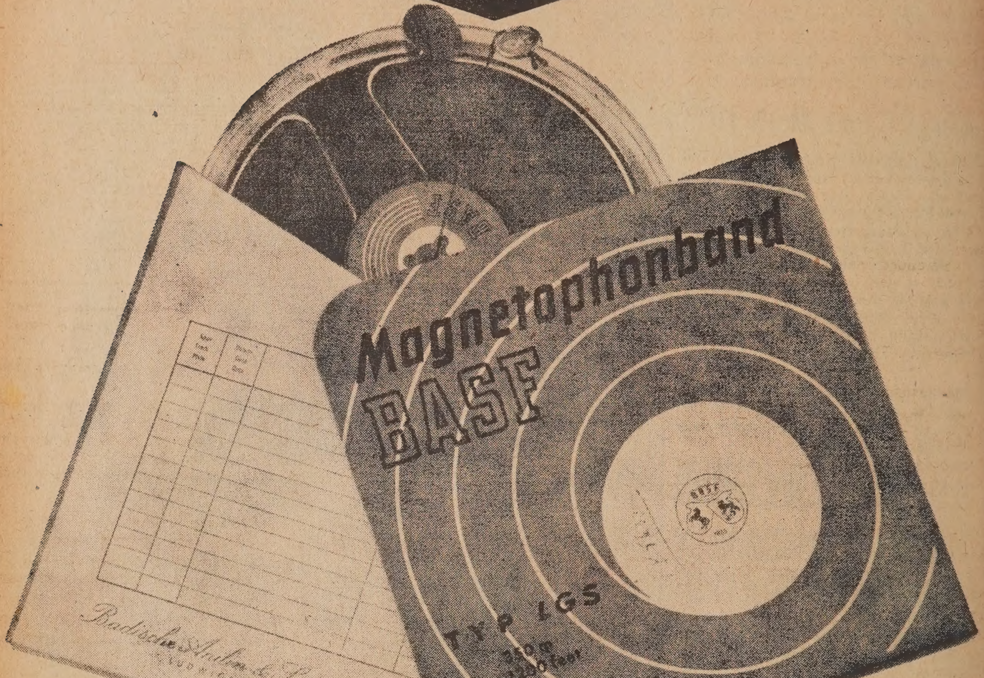
Telephone conversations are also well within the ken of the Minifon. A small adaptor with a rubber suction cup on its base can be plugged to the base of the telephone, close to the coil. Both sides of the conversation are distinctly recorded by induction. Such recordings, in Australia, are of course illegal.

Finally, for use in noisy workshops, road testing motor cars or other occupations, a throat microphone picks up every word of the speaker's voice and elminates all background confusion.

Truly a mighty Minifon!

# THE NEW *RED-BACK* BASF MAGNETOPHONBAND
# TYPE LGS STANDARD 1200FT. RECORDING TAPE

## *TAPE CAN'T UNROLL*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## *CARTON-TOP CAN'T BE LOST!*

**BASF tape comes to you with these features:**

- The red-plastic safety clip ensures that the tape won't unroll.
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- The clever design carton ensures that the top can't be lost when tape is in use.

**BASF, the world's first recording tape, is the choice of the Australian Armed Services and over 90% of Australian radio stations.**

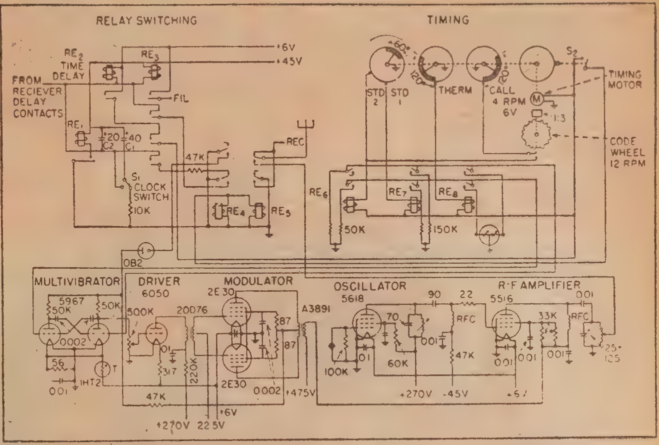
**BASF** **Distributed by Maurice Chapman & Co. Pty. Ltd., 31 Macquarie Place, SYDNEY. BU6401**

# BUOY TELEMETERS OCEAN DATA

ONE such buoy has been developed containing a receiver, transmitter, measuring and timing equipment. It can be set to transmit temperature data at predetermined times or can be be made to respond to a signal sent out by the base transmitter through the internal low-consumption transistor receiver, which is left operating continuously.

The signal from the buoy, modulated by a thermistor-controlled R-C oscillator, transmits water temperature in terms of the modulation frequency.

A crystal oscillator designed to operate in the 2 to 3 megacycle range drives a single-ended plate modulated power amplifier in the transmitter unit. Fast-heating filament-type valves are used to minimise warm-up time and consequent battery drain. Input power to the final is approximately 30 watts.


RELAY SWITCHING
TIMING
RE2 TIME DELAY
RE3
+6V
+45V
FROM RECIEVER DELAY CONTACTS
FIL
RE1
20 C2
40 C1
47K
REC
S1 CLOCK SWITCH
10K
RE4
RE5
RE6
RE7
RE8
50K
150K
STD 2
STD 1
THERM
CALL
4 RPM
6V
1:3
TIMING MOTOR
CODE WHEEL 12 RPM
S2
OB2
MULTIVIBRATOR
5967
50K
50K
.0002
.56
.001
1HT2
T
DRIVER 6050
500K
20D76
.01
317
220K
47K
MODULATOR
2E30
2E30
87
87
.0002
A3891
+475V
+270V
22.5V
+6V
OSCILLATOR 5618
90
22
70
.001
RFC
100K
.01
60K
47K
R-F AMPLIFIER 5516
.001
33K
RFC
.001
.001
25-125
+270V
-45V
+6V

Relay switching unit and timing motor control operation of telemetering transmitter to broadcast standard tones, temperature tone and identifying code signal.

**Increasing cost of operating oceanographic vessels emphasises the need for a method of making semicontinuous measurements at many different locations independently of the ship. Telemetering anchored buoys can provide measurements of surface or deep temperatures, or when allowed to drift can provide ocean current and circulation data.**

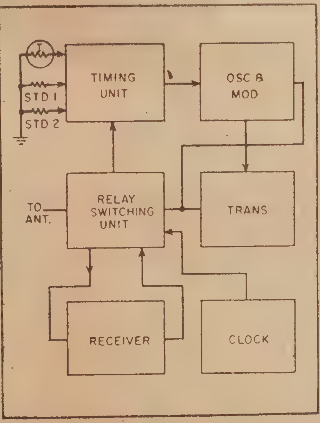
The accuracy of temperature measurements is dependent upon the frequency stability of the multivibrator which generates the modulation frequency. The maximum error is plus or minus 0.2 degrees centigrade.

Overall, the transmitter modulator consists of the multivibrator, driver and push-pull modulator, all of conventional design. The frequency of oscillation of the multivibrator is controlled by the grid resistors. Precision, low temperature co-efficient resistors are used to establish the two standard tones, whose frequencies correspond to the upper and lower extremes of the thermistor range. Thus a means is provided to detect frequency drift caused by decay of the battery supply voltages. Both the plate voltage and filament current of the multivibrator are regulated to ensure maximum frequency stability with supply voltage variation.

## LOW BATTERY DRAIN

Since the receiver must run continuously during the life of the buoy the most important consideration is low battery drain. It employs nine transistors in a superhet circuit. To achieve the high sensitivity required for long-range operation, a stage of RF amplifications and two stages of IF amplification are included.

All stages through to the second detector are surface barrier transistors chosen for their high frequency response and low power consumption. The transistor push-pull, class B output stage drives a resonant-reed relay. No forward emitter bias is used in this amplifier, since distortion of the output stage does not materially affect operation of the the relay. Power consumption of the output stage is thus negligible in the absence of an input signal. The resonant-reed relay contacts are in series with a sensitive DC relay shunted by a capacitor.


TIMING UNIT
STD 1
STD 2
OSC & MOD
TO ANT.
RELAY SWITCHING UNIT
TRANS
RECEIVER
CLOCK

All sections of telemetering buoy are controlled by relay switching unit.

The buoy has been reliably triggered and read at ranges up to 300 miles at frequencies between 2 and 3 megacycles. This range has been increased to as much as 600 miles by triggering at times of optimum propagation.

In operation, a number of buoys are anchored at locations determined by the physical problem to be investigated. The buoys transmit and receive on the same frequency, but each buoy responds to an interrogating signal only if the signal is modulated with a tone of particular frequency.

## QUICK HEATERS

Vibrating reed relays are used in the output of the buoy receivers to obtain a narrow audio frequency response that almost entirely eliminates accidental transmission caused by noise and interference. The interrogating transmitter is modulated by tones derived from a resonant reed controlled oscillator with a separate resonant reed for each tone.

The reception of the proper tone by the buoy receiver actuates a time relay which allows quick heating transmitter filaments five seconds warmup time. The transmitter is then keyed with the call sign followed by the three consecutive tones.

The total transmission lasts 15 seconds. At two transmissions per day the estimated battery life is about two months. The FM/AM signal is received on a standard communications receiver and recorded on magnetic tape. The tone frequencies are then measured. In the event of garbled reception the buoy may be triggered again at a more favourable time.

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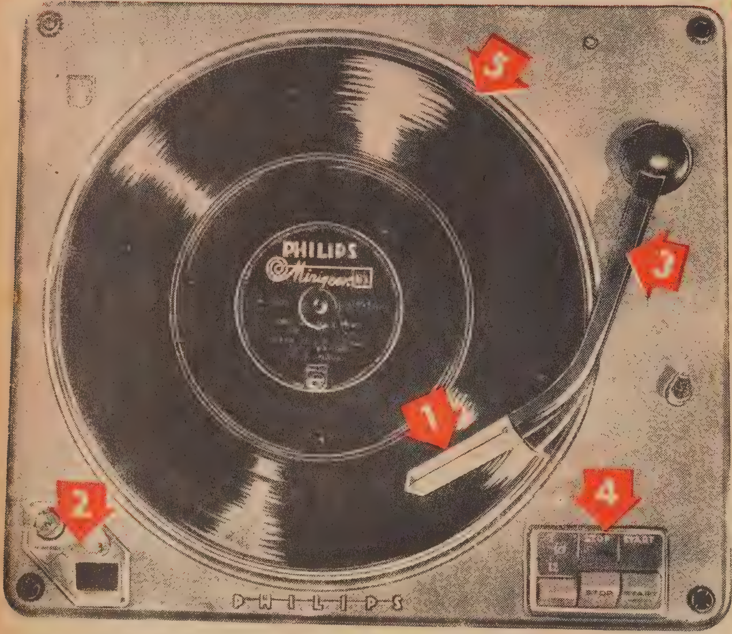
# PHILIPS AG 2005



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# DENTIST'S CLOSED-CIRCUIT TV

The largest dental college in the United States is using closed-circuit television as a new teaching medium to speed instruction and to keep abreast of the changing profession. Through use of the new teaching medium, New York University's College of Dentistry hopes to broaden subject courses within the currently heavy curriculum. Thus, students will be apprised immediately of rapidly changing dental practices without need for additional courses.

ACCORDING to the dean, Dr. Raymond Nagle, he has already noted a saving of 5½ hours in the teaching of one particular course.

In this instance, about 20 minutes were expended to demonstrate and lecture to 70 students in the fundamentals of filling a tooth. Under previous methods, the course would of necessity have to be taught to the students in groups of six or seven, or as many as were able to group around a professor at a dental chair.

In this fashion, each instructional period would have required about 35 minutes. Thus, the complete class of 70 students, taught in groups of seven each, would have required a total of 350 minutes of instruction, as against the 20 minutes by TV for the entire class.

The 5½ hours thus saved can now be devoted to laboratory classes or for additional instruction in other dental practices. In addition, details which were previously hurried over can now be emphasised.

What about attention to instruction and retention of learning? "Excellent," says Dr. Nagle. During this particular instruction and lecture, the 70 students, seated comfortably in front of two 21-inch TV receivers, were "so quiet you could hear a pin drop." Examinations following the lecture—anywhere from one day to one week after—disclosed that students had been very perceptive and receptive to the lecture and televised demonstration.

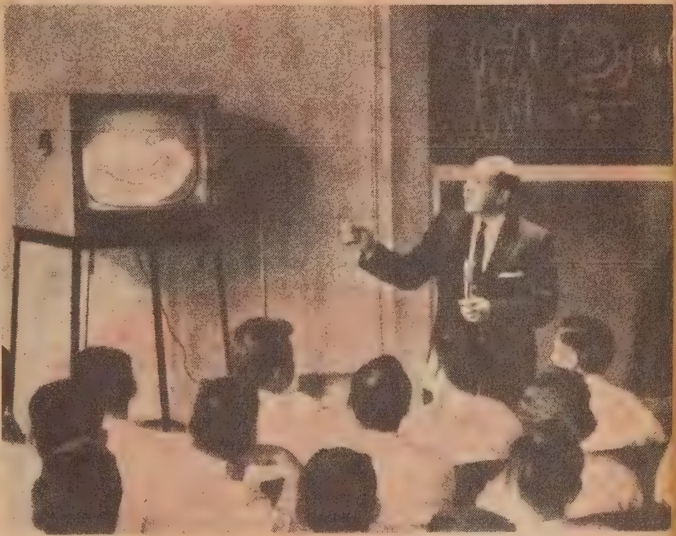
How does this teaching method compare with use of educational films and other visual aids? Dr. Nagle explains that "television is immediate while instructional films of the rapidly-changing dental profession are obsolete almost before they can be produced."

For instance, Dr. Nagle continued, a new therapeutic treatment of today may be outmoded within a year by newly-discovered and more efficient methods. Thus, the many months required to put the film together are practically written off before the film is ready for shooting.

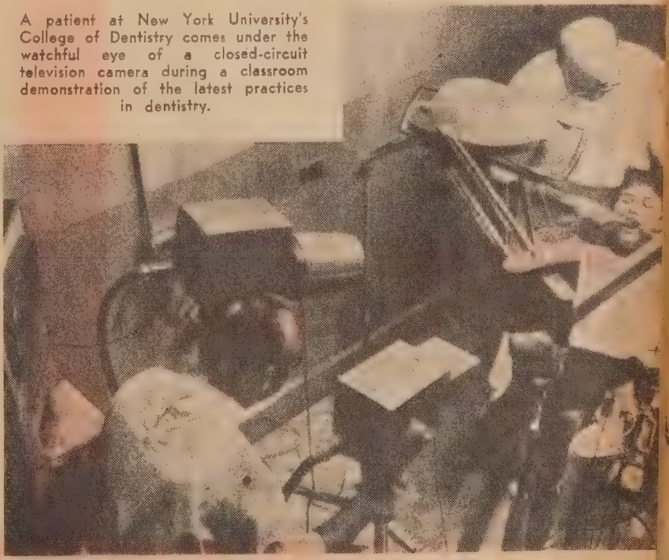
The lecturers readily admit they are not yet television experts but say they are daily improving their camera techniques. They are keeping records of new lighting techniques and camera angles in order to provide future advice and information to other dental educators as they become interested in teaching by closed-circuit television.

For instance, they have found that 21-inch receivers are the most effective for viewing. Larger screens, they believe, would lose much of the necessary clarity and detail for accurate perception.

Demonstrations are televised from central studio at the college and "piped into several lecture halls on various floor of the building. Two General Electri TV cameras are used in the studio; on equipped with a wide-angle lens fo overall viewing; the other with a Perkin Elmer variable focal length Zoom lens



Shown here is a class of more than 70 dental students during a televised lecture. The lecturers explain the dental techniques while studio professors televise the demonstration.



A patient at New York University's College of Dentistry comes under the watchful eye of a closed-circuit television camera during a classroom demonstration of the latest practices in dentistry.

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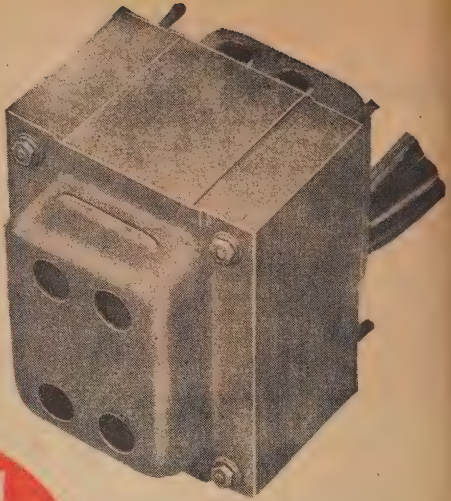
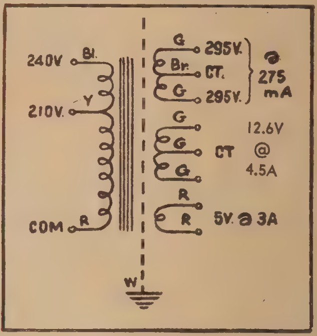


**TRANSFORMER RH275/295**
Dimensions (upright mounting)
4½in x 3¾in, chassis height 4¼in.



CHOKE RH1/275
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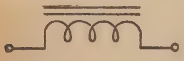

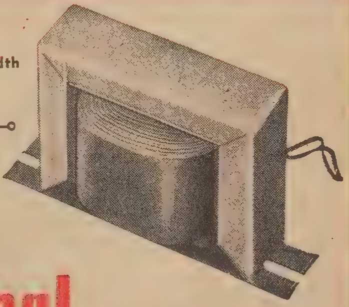

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# GIANT REFLECTOR AT JODRELL BANK

**At Jodrell Bank, in Cheshire, England, is being built a giant radio Telescope for the University of Manchester which will be used to detect radio waves emanating from the stars**

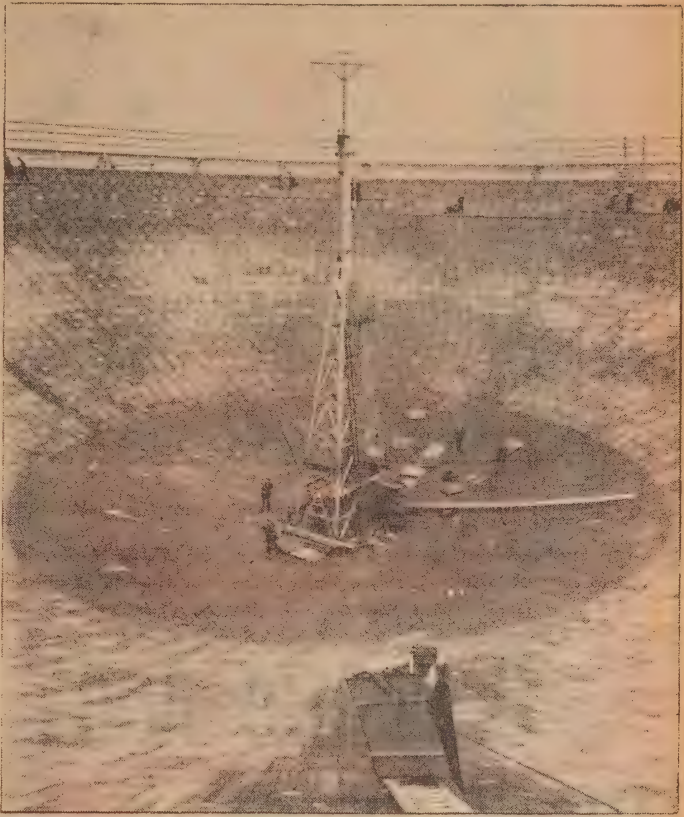
THE telescope, claimed to be the largest in the world, weighs 2000 tons, and despite its great weight, is easily and competely steerable so that it can be cocked like a giant ear to any part of the sky.

The maximum height of the telescope is 300 ft and the reflector bowl, in the centre of which is the aerial, weighs 750 tons.

The bowl concentrates the signals received over its area on the aerial array, thus giving very high gain and directivity.

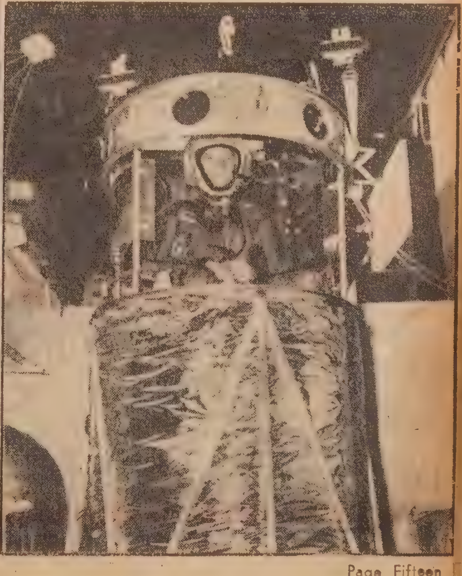
The telescope will be of immense value to scientific research, for astronomers will be able to detect "radio" stars from greater distances, and measure their position more accurately. It can also be used for checking radiations from the sun.

## RADIO TELESCOPE TAKES SHAPE



Below—Tiny silicon wafers, or solar batteries, grouped in long narrow clusters on the crown of the U.S. soldiers helmet can provide all the electrical power needed to operate his transmitter-receiver. Teamed with small, nickel-cadmium storage batteries for peak power and night-time operation, the cells provide current for as much as a year's as compared with dry cells the life of which is measured in hours.

Below—This U.S. Air Force airman hopes to reach 95,000ft in hours with a record balloon flight



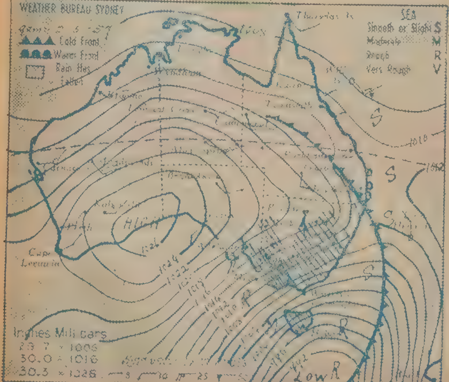
# Air Pressure And The Weather

By CALVIN WALTERS

The constant change in the pressure of the air on the surface of the earth is responsible for variations of weather. This article shows how the movement of "highs" and "lows" affects Australian conditions. Figure numbers refer to maps in order of date.

A dramatic cloud picture showing the wake of a seeded aircraft engaged in rain-making experiments.

THE drought conditions recently prevailing over the Australian continent caused more people than usual to take an interest in the daily weather reports which are given over the radio and in the newspapers.



Unfortunately these reports do not give an adequate idea of the causes of the weather conditions beyond the bare statement that a "high pressure system at present centred over N.S.W. is bringing continuing fine weather."

Of course there are all sorts of arguments going on in trains, cafes, offices and farms as to the cause of the drought.

Many people blame the atom and hydrogen tests of course. That is to be expected. Anything of an unusual nature is always blamed by somebody as being the cause of something or other and the atom bomb or as it is more politely called. the nuclear tests, is the popular victim at present.

We have had severe floods in the past few years. The atom bomb was blamed for that. We had severe heatwaves. Atom bombs again. We had big snowstorms in various places. Atom bomb again.

Thus the atom bomb becomes the most versatile cause of all the troubles which have beset mankind since the first one was let off over Hiroshima. It causes apparently anything from the insane actions of politicians, the trains being always late on N.S.W. railways, floods, droughts, heatwaves, coldwaves, behaviour of bodgies, births of four-legged babies and two legged calves and now we await the news that it is the cause of the Singapore influenza.

## BLAME THE SUNSPOTS

The same was said about sunspots and this is still a popular theme with long-range forecasters, although nobody has yet explained why a sunspot 93 millions of miles away can pick out such a small area of the earth's surface as say New South Wales to cause a flood or a drought while the opposite conditions prevail a few hundred miles away in a neighbouring State.

There may be something in all this I couldn't say. What goes on "up there" is anybody's business and jolly hard to find out.

The fact of the matter is that we have been having the same sort of weather conditions on and off since weather conditions have been recorded, and as far as we know they are governed by variations of the pressure systems over the earth's surface.

As a matter of fact it is these pressure systems together with temperature and other readings upon which weather forecasts are based. And they are more accurate over a period than most people seem to imagine despite the belting that the poor old weather man get from time to time.

## FORECAST ACCURACY

What sort of belting he gets seem to depend on whether he is a Government man or a private forecaster. It seems to be an inherent trait of human nature to publicise the failures of a Government institution more than the successes whilst publicising the successes of the private forecaster and forgetting his failures.

I propose to leave it at that before I start getting into strife myself. I don't know of a more controversial subject. I bet even now there are fellows starting to write letters before they even read what is to follow.

Our atmosphere lies like a blanket over the earth. It is four-fifths nitrogen. The other fifth is mostly oxygen with carbon dioxide and water vapour and a few other gases in traces.

The force of gravity prevents the atmosphere from stream- off into space. Thus it has weight so that there is a column of weighing about half a ton resting on our heads.

The actual height of the atmosphere above the earth has t been proved but it is known that appreciable amounts exist 0 miles up. Nevertheless more than half the weight of the at- osphere is contained in the layer of air below a level of 20,000 t.

It has been estimated by Gordon Cook that for every million s particles in the air at sea level there is only one at a height of miles.

Whilst a particle of air at sea level is separated from its ighbour by only a few millionths of an inch, at a height of 0 miles they are separated from each other by a distance of 00 miles.

Air is subject to the influence of the heat of the sun and the oling effects of the polar caps. It becomes lighter when heated d rises. When cooled it becomes heavier and falls.

The temperature of the air varies with height. It falls in mperature as we rise and at seven miles high it is minus 67 grees Fahrenheit. This is the height of the lower level of the mosphere called the troposphere.

Above this is the stratosphere where the air is calm. There e no clouds or storms, very little dust. It is crisp, dry and clear r there is little water vapour.

As we rise higher into the stratosphere to a height of 30 iles the air becomes warmer and reaches a temperature of 170 grees Fahrenheit. At a height of 50 miles the air becomes ld again dropping to minus 117 degrees.

Whilst the air is calm in the lower levels of the stratosphere ere are very violent winds in the upper layers. Above 50 miles gh the winds move eastwards at speeds of up to 300 miles an our. These are the jet streams, recently discovered during the ar.

## HE TROPOSPHERE

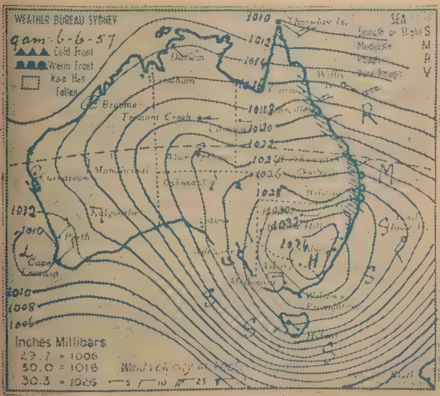
The troposphere is the layer of air which mostly concerns u s it is here that our weather is formed. It is the home of water apour which forms clouds and gives rain. It transports the water apour from one place to another. Its jet streams by undulating ack and forth from the equator to the pole cause out of season ariations in the weather such as heat waves in early winter and now or frost in spring.

During the winter the jet stream surrounds the earth over th ropic of Cancer then it moves northward during the summer to ards the Arctic Circle. It moves faster in winter than in summer

However it is not always steady and sometimes wanders abou ike a snake firstly travelling towards the equator for a few thou nd miles. Then it curves upward to the poles then down an p again along the outskirts of the cold air near the pole.

During this up and down meandering the jet stream caus reat disturbances in the air. It drags vast quantities of cool pol ir downwards towards the equator and at the same time drag varm air upwards towards the pole. Having done this for pe aps a few weeks it returns to its normal course in a more direc oute round the earth. Thus it cuts across these huge tongue of cold and warm air which it switched around and leaves ther ying over vast areas of land below.

It is no wonder then that the jet stream when it gets "of course" causes great changes in the weather—changes which ar evident as sudden drifts from summer to winter or vice vers Scientists are becoming more and more convinced that it is th t stream which contains the clue to better forecasting. When nore is learned about its behaviour and more efficient means are ound for tracking its movements then our weather forecasting vill have reached a higher peak in accuracy.


WEATHER BUREAU SYDNEY
9 am 6-6-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Darwin
Broome
Tennant Creek
Perth
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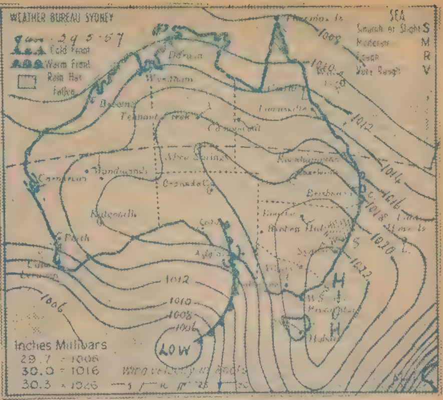
LOW
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026


WEATHER BUREAU SYDNEY
9 am 29-5-57
Cold Front
Warm Front
Rain Has Fallen
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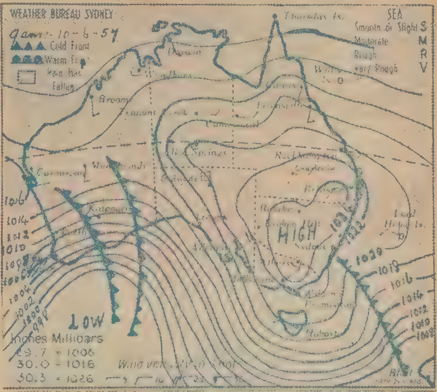
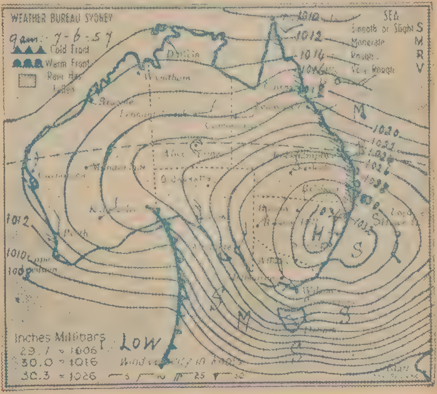
30.0 = 1016
30.3 = 1026


WEATHER BUREAU SYDNEY
9 am 10-6-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is.
Darwin
Broome
HIGH
LOW
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026


WEATHER BUREAU SYDNEY
9 am 7-6-57
Cold Front
Warm Front
Rain Has Fallen
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Moderate M
Rough R
Very Rough V
Darwin
Perth
H
LOW
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026

So we see that during the course of a year the atmosphere is ubjected to great strains and stresses which keep it in a contant state of movement. It is heated at the tropics and cooled over the poles. The earth during its revolution drags the air with it. The uneven warming and cooling of the land and water below the air cools or warms the air at land levels at an uneven rate causing uneven contraction or expansion. Water evaporates and the vapour soaks into the air, being carried to great heights and over long distances. The jet stream agitates the air and drags it across equator and pole.

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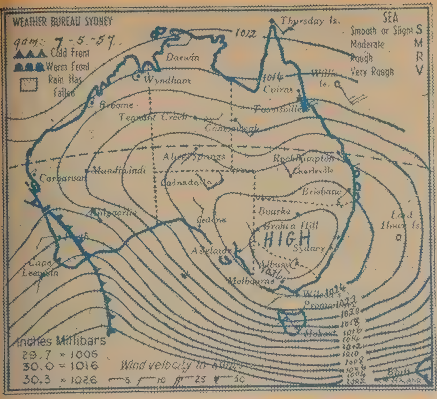
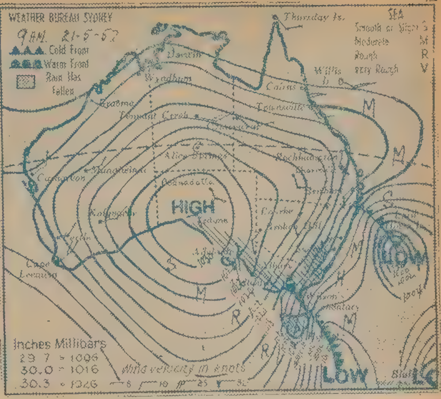

WEATHER BUREAU SYDNEY
9am: 7-5-57.
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is.
Darwin
Wyndham
Cairns
Willis Is.
Broome
Tennant Creek
Townsville
Camooweal
Alice Springs
Rockhampton
Mundiwindi
Charleville
Carnarvon
Oodnadatta
Brisbane
Kalgoorlie
Bourke
Lord Howe Is.
Ceduna
Broken Hill
HIGH
Adelaide
Sydney
Cape Leeuwin
Melbourne
Hobart
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026
Wind velocity in knots
5 10 25 50


WEATHER BUREAU SYDNEY
9AM. 21-5-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is.
Darwin
Wyndham
Willis Is.
Cairns
HIGH
LOW
Cape Leeuwin
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026
Wind velocity in knots
5 10 25 50

The result of all this is the creation of enormous whirlpools in the air which are carried in a fairly regular pattern across the surface of the earth.

These whirlpools have been studied for centuries and the courses mapped so that with the measurements of pressure, temperature and other factors they have become the basis of the weather maps published in our daily newspapers.

If you glance at the map of Fig. 1 you will see that there are a series of concentric lines in three places. To the left near Cape Leeuwin the lines have "Low" in the centre. At the centre of the Great Australian Bight is a larger series having "High" at the centre. Off the East Coast of the continent there is another "Low" series.

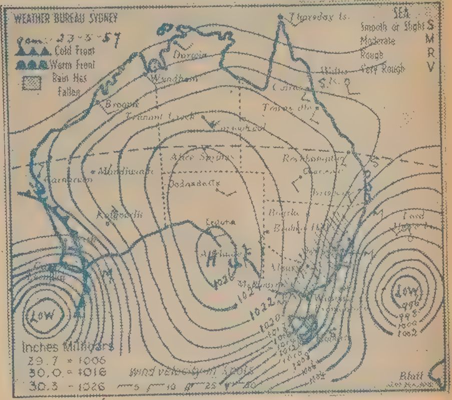
These lines are drawn through places where the weight of the air above is equal. This is measured with a barometer and is called the pressure.

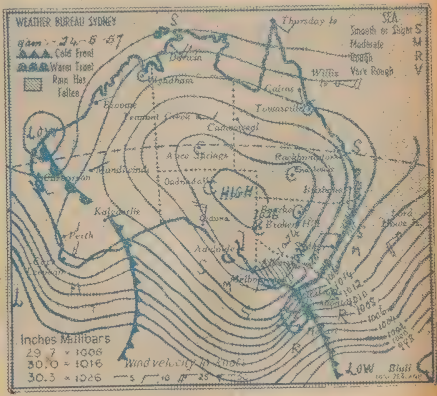
The wind direction is given by means of arrows drawn between the lines. It will be noticed that the arrows point outwards away from the centre of a "High" and inwards TOWARDS the centre of a "Low".

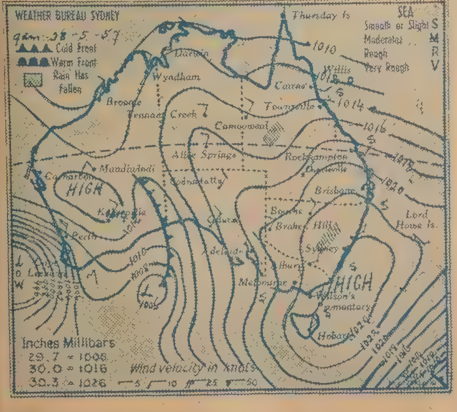
## ISOBARS AND MILLIBARS

The concentric lines are called Isobars and each is marked with the pressure in millibars. Note that the pressure gets lower towards the centre of a Low and higher towards the centre of a High. The winds blow outward away from the centre of a High and revolve in an anti-clockwise direction as shown by the small arrows. In a Low pressure the winds flow towards the centre of the Low and revolve in a clockwise direction. In other words the air behaves the same as water and flows away from regions of high pressure towards regions of low pressure. It is like opening a valve in the tank of air at a service station to fill your car tyres. The air in the tank is at a higher pressure and flows into the low pressure area of the tyre.

When the air pressure as measured on the barometer rises or falls rapidly between places fairly close together it causes the lines on the map to be tightly packed. This is shown nicely between the two Lows and the High of Fig. 1. In these areas the winds are very strong and may reach hurricane force.


WEATHER BUREAU SYDNEY
9am: 23-5-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is.
Darwin
Wyndham
Willis Is.
Broome
HIGH
LOW
LOW
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026
Wind velocity in knots
5 10 25 50


WEATHER BUREAU SYDNEY
9am: 24-5-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is.
Darwin
Wyndham
Willis Is.
Cairns
Broome
Townsville
LOW
HIGH
Perth
LOW
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026
Wind velocity in knots
5 10 25 50

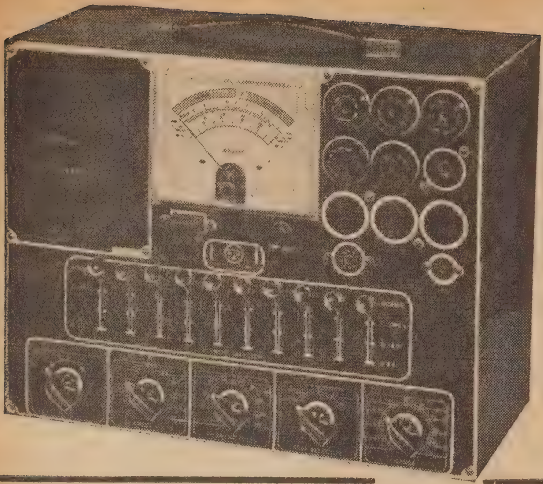

WEATHER BUREAU SYDNEY
9am: 28-5-57
Cold Front
Warm Front
Rain Has Fallen
SEA
Smooth or Slight S
Moderate M
Rough R
Very Rough V
Thursday Is
Darwin
Wyndham
Willis Is.
Cairns
Broome
Tennant Creek
Townsville
Camooweal
Alice Springs
Rockhampton
Mundiwindi
Carnarvon
Oodnadatta
Charleville
HIGH
Brisbane
Kalgoorlie
Bourke
Lord Howe Is.
Perth
Broken Hill
Adelaide
Sydney
Melbourne
HIGH
Wilson's Promontory
Hobart
L
Inches Millibars
29.7 = 1006
30.0 = 1016
30.3 = 1026
Wind velocity in knots
5 10 25 50

In areas under the influence of the High pressure or ANTICYCLONE the air is flowing outwards and downwards carrying moisture away. Thus the weather is fine and the sky cloudless. The nights are usually cool and the day warm.

In areas under the influence of a Low or cyclone the air is flowing inwards and upwards carrying with it the water vapour which condenses into cloud. The air is muggy and oppressive and there is a tendency for rain to fall if other conditions for condensation are right.

Therefore it is to the Low pressure system that we look when we want rain and unless such a system is present rain will not fall. During the winter month the High pressure systems move across Australia in higher lattitudes so that their centres usually cross the continent somewhere about or above the "dead heart."

**Continued on Page 119.**



## VALVE TESTER MODEL TVT.

This is the latest in valve testers and is flexible over a very wide range allowing all types of tubes to be tested irrespective of their pin connections. Individual lever switches are used for every pin, and a range of twenty filament voltages allow all types of tubes to be tested quickly and accurately. It is designed for ordinary radio use as well as for testing TV tubes, and can be used as a portable instrument or bench instrument.

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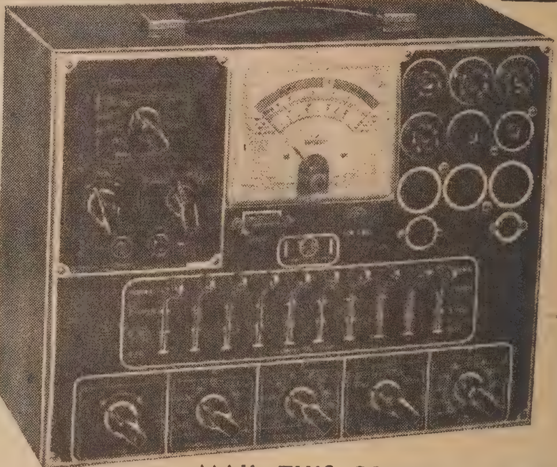
The Model TST needs no introduction to the radio and TV service industry in Australia, and Model TST/2 is built on the same basic principles of good quality and lasting service, but with improvements to allow testing of TV tubes and to give it a more flexible range than TST. As well as having all the features of Model TVT valve tester, it allows AC/DC and output voltages to be checked up to 1,000 volts. together with a range of D.C. current up to 250 milliamperes and self-contained resistance ranges up to 10 megohm. Designed to operate from A.C. it is supplied with instruction booklet and test leads.



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# Technical Review

## NEW NOISE GATING TUBE DOES MULTIPLE DUTY IN TV

An interesting description of the new type 6BU8 released overseas is contained in this article from "Electronics." The entire functions of sync clipping and generating AGC voltage are combined with a high degree of noise immunity. The valve contains a common cathode, grid and screen with separate plates and number three grids.

NOISE gating—discriminating against noise pulses on the basis of their amplitude — is combined in the system to be described with a good sync clipper and AGC circuit in simple form.

The effect of impulse noise on automatic gain control and sync separating circuits can best be considered by first examining a simple unprotected circuit such as that of Fig. 1. One triode is employed as a self-biased sync clipper. Another triode is used for automatic gain control of the RF and IF amplifiers of the receiver in response to the output of the video amplifier.

The video amplifier output has positive-going sync and includes the DC component of the composite video signal. A portion of this output is applied to the AGC tube grid, by a resistive divider. The grid is biased beyond cutoff by the positive potential of the cathode. The AGC delay control setting determines the level at which the video amplifier output will stabilise.

A resistive divider between anode and high negative supply of 75 volts provides zero or a slightly positive voltage at the AGC output and establishes the no-signal anode potential. With signal the anode draws current, its DC potential falls, causing the AGC control point to go negative and thus reduce the receiver gain. The positive-going sync pulses of a signal of moderate strength extend to about the centre of the grid-control characteristic.

A portion of the video output is applied through a coupling capacitor to the grid of the sync clipper triode. The sync output amplitude is limited by the low plate voltage provided. The depth of clipping is determined by the grid leak resistance and by the amplitude of the applied signal. The clipped sync output goes through suitable networks to the vertical and horizontal synchronising circuits.

Noise will cause havoc in such an unprotected circuit. Noise pulses are generally of greater amplitude than sync pulses and produce plate current pulses over twice as large as the sync pulses; they can bias the AGC severely.

In the sync clipper output the noise pulses are as large as the sync pulses. With high noise levels the grid coupling capacitor may charge up and cause complete loss of sync for a period following a noise pulse until normal bias is restored.

### TIME GATED AGC

One system that has been used with reasonable success to reduce the effect of impulse noise is the time gated AGC shown in Fig 2. Time gating means turning the AGC tube on only during the brief interval when it is needed. Since the triode must conduct current only during the horizontal sync pulse, it is turned on a short period before the occurrence of the sync pulse and turned off soon afterwards.

This action prevents any anode current in response to noise for the periods between gating intervals. Since the gate pulse is taken from the horizontal sweep circuits, these circuits must be in synchronism before the AGC can produce the proper receiver gain and contrast level. In the circuit shown in Fig 2 the triode is operated as a gated diode, with the AGC voltage produced by rectification of the gate pulse.

Such a circuit gains a certain degree of noise protection for the AGC. But for the sync clipper, time gating proves impractical. Vertical sync output would suffer. Pull-in of the horizontal sweep would be slow, since until synchronism is established there is no output.

If time gating is not suitable for a sync clipper circuit, amplitude gating can prove useful. Noise pulses, if they are large enough to impair reception,

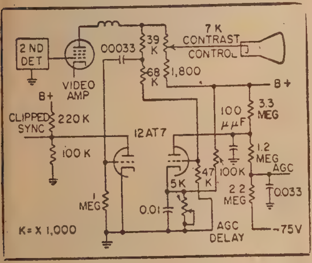
2 ND DET
VIDEO AMP
B+
00033
39 K
68 K
7 K CONTRAST CONTROL
1,800
B+
CLIPPED SYNC
220 K
100 K
1 MEG
12AT7
100 μμF
3.3 MEG
47 K
100K
1.2 MEG
AGC
5K
0.01
2.2 MEG
0033
AGC DELAY
-75V
K = X 1,000

Fig. 1: Simple unprotected circuit for AGC and sync output separation.

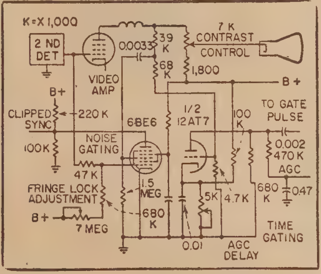
K=X 1,000
2 ND DET
0.0033
39 K
68 K
7 K CONTRAST CONTROL
1,800
VIDEO AMP
B+
CLIPPED SYNC
220 K
100K
6BE6
NOISE GATING
47 K
FRINGE LOCK ADJUSTMENT
B+
7 MEG
1.5 MEG
680 K
1/2 12AT7
100 K
5K
4.7K
0.01
AGC DELAY
TO GATE PULSE
0.002
470 K
AGC
680 K
0.47
TIME GATING

Fig. 2: Impulse noise is time gated but vertical sync output suffers.

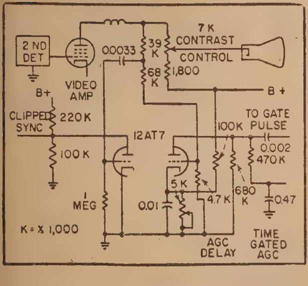
2 ND DET
VIDEO AMP
B+
00033
39 K
68 K
7 K CONTRAST CONTROL
1,800
B+
CLIPPED SYNC
220 K
100 K
1 MEG
12AT7
100K
TO GATE PULSE
0.002
470 K
5 K
0.01
4.7 K
680 K
0.47
K = X 1,000
AGC DELAY
TIME GATED AGC

Fig. 3: Triode clipper replaced with pentagrid tube in amplitude gating.

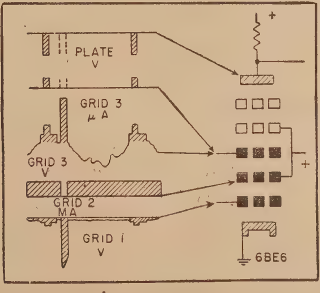
+
PLATE V
GRID 3 μA
GRID 3 V
GRID 2 MA
GRID 1 V
+
6BE6

Fig. 4: Relations at various tube electrodes for circuit of Fig. 3.

# from the new Mullard catalogue

*Precision pulse Generator*
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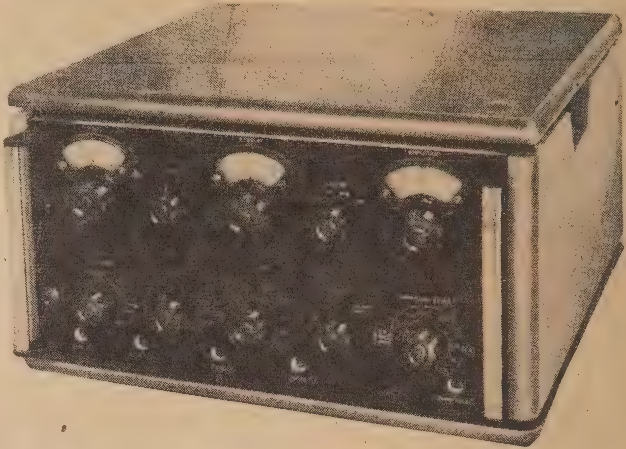
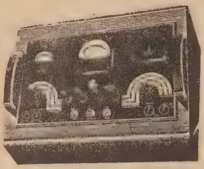
The pulse generator type L.141 provides two main pulses with accurately controllable amplitude, duration, p.r.f., and separation, together with additional pulses for triggering or synchronising.

The amplitude of the two main pulses is continuously variable between 300μV and 100V, their duration from 0.5 to 100μs, and the separation between them from 0 to 100 ms.

An internal oscillator provides repetition frequencies from 1c/s to 100kc/s.





*Transistor Tester*
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The Mullard Transistor Tester has been developed to provide a rapid means of checking general characteristics and ascertaining if a transistor has been damaged in circuit. Facilities for measuring the important parameters, α, base-collector short-circuit current gain, as well as $I_{co}$ and the collector turnover voltage are provided. Although designed as a simple testing unit, it has an accuracy of ±5%.

*Dual Trace Oscilloscope*
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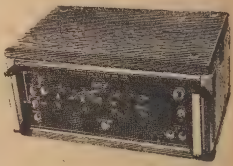
This high grade, general purpose instrument incorporates two identical amplifiers with sensitivities of 20mV/cm over a bandwidth of 4Mc/s. Voltage measurements (±5%) and time measurements (±10%) are by null methods. The time base may be free running or triggered, and sweep speeds are from 0.1μs/cm to 10ms/cm.



*Television Line Selector*
L196

The L.196 enables any normally triggered oscilloscope to give a jitter-free display of one or more lines from a television video signal. It can be used on transmitter and receiver units to display depth of modulation, d.c. levels, bandwidth, blanking, synchronizing pulses and for the examination of similar waveforms in detail.

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enerally show a greater amplitude than he sync tips and a number of circuits ave been devised to utilise this difference.

In Fig. 3 the triode clipper is replaced with a pentagrid tube such as the 6BE6. The sync clipper grid is grid 3. The anode is operated at a low voltage through a resistive divider to limit the sync output amplitude. The output of the second detector is applied through a 47,000-ohm series resistor to grid 1. This grid is made to operate near zero bias by connecting it through a high resistance to a positive potential. As a result, considerable grid current flows, reducing the resistance between grid and cathode to a few thousand ohms. Video and sync portions of the signal, applied through the 47,000-ohm resistor, are nearly shorted out and have little effect on the anode current.

## ACTION ON NOISE

During negative noise pulses, however, the grid current is reduced to zero, the short-circuit is removed and a pulse of sufficient amplitude will easily cut the tube off as indicated in Fig. 4. A positive replica of a noise pulse appears simultaneously at the clipper grid 3 but it is rendered harmless since there is no current available for the duration of the pulse.

Strictly speaking, a slight disturbance may come through, because noise pulses do not rise or fall with infinite speed and there is an intermediate region where grid 3 is already turned on and grid 1 not yet cut off. For this reason a brief transient appears at the beginning and at the end of each noise pulse. In practice these transients are too short to cause significant harm.

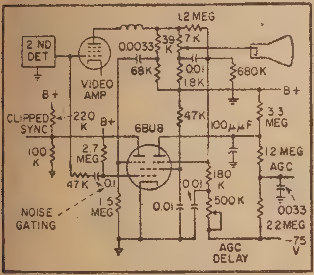

Fig. 7: New type 6BU8 tube simplifies circuit shown in Fig 5.

For maximum noise protection, noise pulses should be gated out slightly beyond the sync tips. The gating level is made adjustable by the so-called fringe lock control, which varies the amount of grid current flowing into grid 1. For weak fringe area signals maximum protection is desired; this corresponds to a maximum resistance position of the control.

However, for moderately strong signals, such a setting gives rise to an instability that has been dubbed split-phase hang-up. To avoid this, the noise gating level must be raised somewhat, corresponding to a lower resistance position of the fringe lock control.

Split-phase hang-up can be traced to the use of an amplitude-gated sync clipper in combination with a time-gated automatic gain control. For example, if the channel selector is switched from a weak to a strong signal, the AGC and clipper circuits will sometimes find a stable condition where the picture is split; the horizontal syncs appear as a black stripe near the centre of the picture and the contrast level is too high. This occurs when, at the instant of switching, the horizontal sweep is about 180 deg. out of phase.

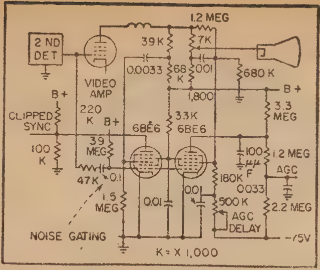

Fig. 5: Second type 6BG6 pentagrid tube is added for AGC amplifier.

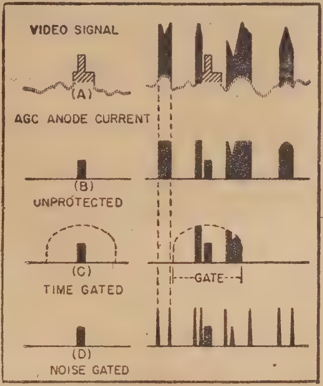

Fig. 6: Comparison of various gating systems in presence of noise.

Since no AGC bias level has been built up, the signal gain is quite high. This causes the sinc clipper to treat the sync pulses like noise pulses and gate them out. Around the centre of the horizontal period some portion of the video may cause the clipper to conduct and produce output. The horizontal frequency control system accepts this output as sync pulses and becomes synchronised in an out-of-phase condition. This causes the time gate for the AGC to continue in the wrong phase—thus suppressing the real sync pulse.

## LEVEL STABILISES

The signal level then stabilises at a point where the video portion previously mentioned is raised to the level where the sync tips should be. This finally perpetuates the condition that started it all—the gain is so high that the sync tips are treated like noise pulses.

This chain of errors cannot occur with weak signals, because even a slight AGC voltage tends to push the video level down low enough. In areas where all signals are weak the control may thus be set for maximum protection. But where stronger channels exist, it must be set to accommodate the strongest.

In Fig. 5, a second 6BE6 pentagrid tube is added for use as AGC amplifier. The time gating is removed and the anode is then connected, as in the original DC circuit, through a network to a high negative supply point, so the AGC take-off point is at zero or slightly positive potential for no signal. The first grid, screen and cathode are in parallel with the sync clipper tube. This provides the same noise gating for both circuits.

Since it is desirable to get high DC gain for the AGC, the cathode is grounded. This allows the anode to operate at a lower potential with less dividing-down in the output coupling network. The AGC control grid is biased negatively with respect to ground to be beyond cut-off for the no-signal condition. It is accomplished by returning a high resistance divider network to a high negative supply point.

## SET BIAS LEVEL

A variable portion of the divider resistance is used to set the bias level and becomes an AGC delay control. This is set for the desired contrast with a fairly strong signal. The divider resistance must be high to prevent excessive loading of the negative supply that in practice is derived from the bias developed across the discharge tube grid resistor.

To prevent the loss in high response caused by coupling the video anode to the grid through a high resistance, a small capacitance connects the grid to the junction between the minimum contrast resistor and the contrast control. For best operation the ratio of AC and DC components on the AGC grid should be about unity.

In the sync clipper circuit, the fringe-lock control has been eliminated. In the absence of time gating in the AGC the conditions for split-phase hang-up no longer exist. The grid resistor can therefore be chosen for best noise protection. Also, a coupling capacitor has been added between the second detector and grid 1. This is necessary to prevent the detector from ever biasing off the AGC circuit for any extended period

## ADVANTAGES

With this new circuit, an improvement in AGC performance is noticed, particularly under heavy noise conditions. Strong interference does not back off the AGC as much as it does when time gating is used; some types of noise actually deprive the AGC anode of current When this happens, the negative control voltage drops and the signal becomes stronger, an effect that is beneficial in maintaining synchronism and apparent contrast under adverse conditions. Moderate to weak noise pulses are gated out cleanly, whereas with time gating the anode would receive extra current during the entire gate periods.

Figure 6 illustrates the difference between the results of time and amplitude gating in the AGC. Line (A) shows the original signal, clean on the left and with various levels of impulse noise on

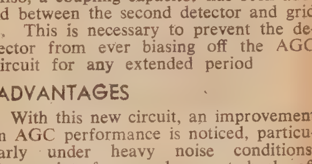

Fig. 8: Average plate characteristics for one section only.

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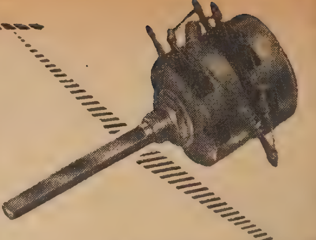

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The I.R.C. new loudness control consists of two separate volume controls operated from a single shaft of standard size and used with a combination of capacitors and resistors which are already wired. The unit will replace any volume control by transposing 3 simple connections, as indicated by the illustration at right. Can be fitted without experience.

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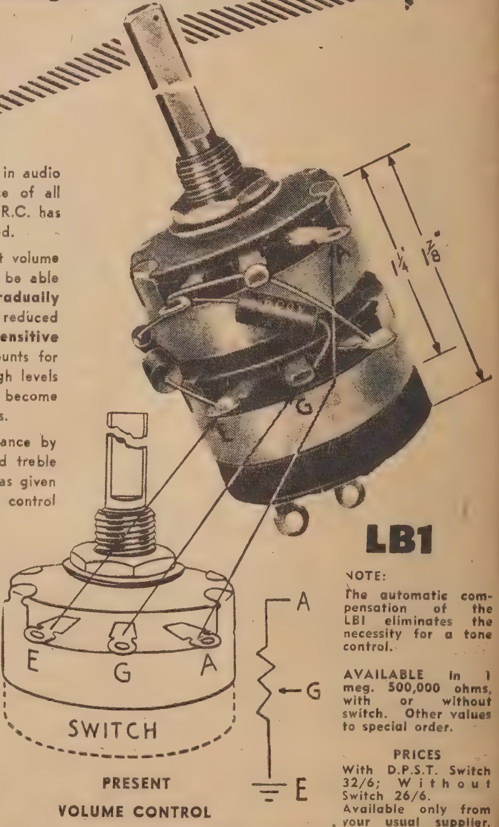

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he right. Line (B) shows how in an unprotected AGC large currents are produced by each noise pulse. In line (C) a large percentage of the noise current pulses has been eliminated. But the largest improvement appears in line (D) where only a few transients reveal that there was any noise present in the input.

It was questionable whether pentagrid tubes were essential for this circuit. High plate impedance seemed unnecessary. Dual control tubes with only three grids such as the 6AS6, or some experimental pentodes with lower current and suitable grid characteristics, built for the specific purpose, served just as well. These considerations led to the development of the 6BU8, which combines in one structure the functions of these two dual-control pentodes.

## CONSTRUCTION

Because of the common gating requirement for both circuits, the cathode, grid and screen are made one structure in the 6BU8. The third grid and anode have been split and are positioned on each side of the screen. The two halves have identical characteristics. Grid 3 and anode on one side serve the AGC and on the other side serve the sync clipper.

Alternatively, the second control grids might also be common. Both grids require a similar composite video signal. If conditions could be so that, when the sync tips extended about to the centre of the transfer characteristic of the AGC side, peak anode current flowed on the sync clipper side, then such a circuit would work.

It would require, however, that the bias on grid 3 be lowered under extremely weak conditions; otherwise the syncs would be lost completely. This would require some carefully designed automatic bias correction, which is not easily found. An expensive alternative would be to increase the IF gain to a point where the peak video output could be maintained all the way down to the noise level.

A self-biased sync clipper, on the other hand, easily provides sync output down to the very weakest signal; thus, there is considerable advantage in keeping it divorced from the AGC.

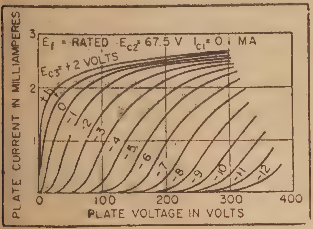

Fig 9: Average plate characteristics (one section) with plate voltage plotted as abscissa.

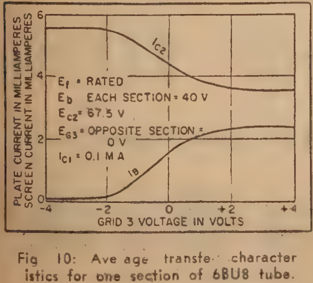

Fig 10: Ave age transfe characteristics for one section of 6BU8 tube.

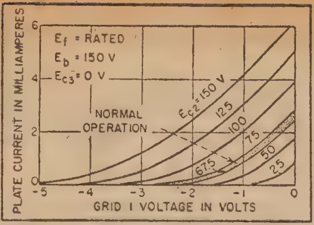

Fig. 11: Plate current plotted against grid-1 voltage shows transfer characteristics of the new tube.

The circuit shown in Fig. 7, using the new type 6BU8, has been used successfully in production sets.

A time-gated AGC tends to obstruct horizontal pull-in if it responds too fast. This effect does not apply here and a time constant shorter than usual can be used, making the sets unusually resistant to rapid fading and airplane flutter.

## CHARACTERISTICS

In the new tube two separate electron streams leaving the cathode may pass through grids number 3 to each of the plates. As grid 3 of either section is made negative, the anode current of that section is reduced and the unaccepted current returned to the screen grid and the shield. The two halves operate independently of each other except for grid 1 and screen grid.

A shield being connected to the screen grid has a threefold purpose. It prevents electrons from flowing around grids 3 to the anodes, it catches the electrons that might otherwise bombard the bulb, and it prevents occurrence of Barkhausen oscillations.

Figure 8 represents the plate characteristics for either section plotted against grid 3 voltage. The AGC section of the tube normally operates with low plate voltage, not far from 20 volts; however, the sync clipper section may work with higher voltages on the plate. Curves are shown for 20, 40 and 80 volts.

A video signal with sync pulses going toward the right increases the plate current to the maximum level, producing only the sync pulse in the output. In the AGC section the sync pulses extend to about the centre of grid 3 control characteristic

Essentially the same information is shown in Fig. 9 except plate voltage has been replotted on the abscissa.

## NEGATIVE GRID

What happens to the electron streams when grid 3 is made negative to block the flow of plate current is shown in Fig. 10. Most, if not all, of this current appears on the screen and shield so that a negative transconductance exists from grid 3 to these electrodes. Since the screen is common to both sections, the effect of both grids 3 shows up simultaneously in the screen current

Figure 11 shows how the plate current in either section is controlled by the voltage on the first grid. In normal operation the screen is at about 70 volts and grid 1 is at about zero volts. A noise pulse of about —2.4 volts will cut off the tube entirely.

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

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- *Radio-gramophone switch.*
- *Provision for tape recorder.*
- *Latest type Radiotron valves.*
- *Straight line dial in four colours, size 12½in by 7½in.*
- *Custom built — six months' guarantee.*
- *Frequency coverage: 40 to 13,500 cycles.*
- *Design tested and approved by the Valve Application Division of Amalgamated Wireless (A'sia) Ltd.*

**PRICE** . . . . £40/15/-

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SPEAKER ENCLOSURES

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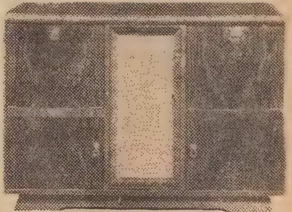

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## RANGE

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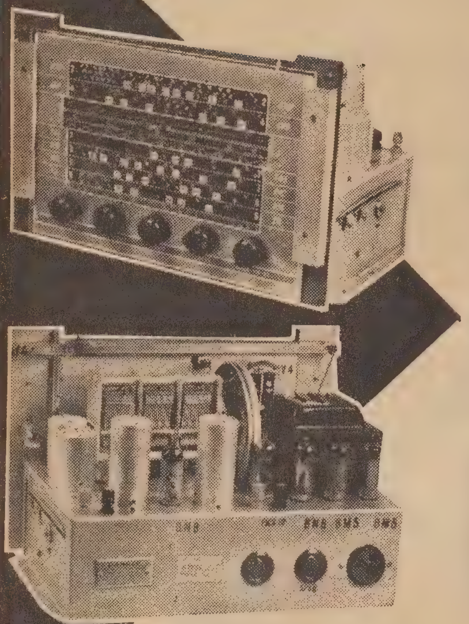

## NEW:

Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator Permatuned iron cored coils and intermediates giving excellent interstate recepotion and a short wave range of 12,000 miles All valves used are the new Mullard nine pin innoval series

## NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings

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If required the new Magnavox high fidelity twin coned speaker can be supplied

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Large calibrated edge-lit dial in plate glass (11in x 4in) with main stations of each State in prominent type. Dial fitted with counterweight drive giving smooth tuning Indicator lights are fitted showing which band is in operation Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets

## NEW.

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate overseas and country stations.

All chassis are wired for the fitting of an F.M tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo motor

Power switch is fitted to volume control, radiogram switch combined with wave change switch Audio end of set can be used with TV receiver if required

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Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT Frequency response 40-13,000 cycles. Max output 10 watts.

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## A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

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We have a complete range of 3-speed record playing equipment, including Dual, Collaro or Garrard Players, with turnover crystal pick-ups or your choice of Garrard, Stromberg-Carlson, Collaro or the new Dual 3-speed changer that will play 7, 10 or 12in records intermixed. All changers have turn-over Crystal pick-ups.

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# Classic Radio

245 PARRAMATTA ROAD, HABERFIELD N.S.W PHONE UA2145

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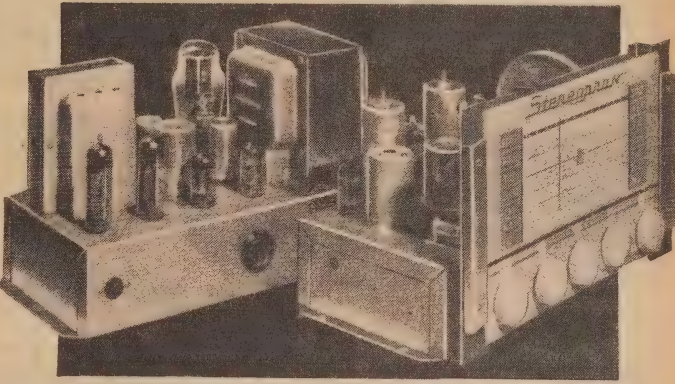
## *Stereophon*

## LIVING SOUND

A compact 11-Valve High-grade Radiogram in two chassis. featuring a variable bandwidth Tuner. multi-input preamplifier and Tone Control in one unit. and a 10 Watt Ultra-linear Amplifier. Ideally suited for use with High-grade Pick-ups and Speakers.



### SUMMARY OF PERFORMANCE

**TUNER:**

Broadcast Band, 2 position Bandwidth, whistle filter, EM80 Tuning Indicator, attractive Dial

**PRE-AMPLIFIER:**

| | | |
|---|---|---|
| Microphone input sensitivity | | 1.5 mV |
| Pick-up input | 1. High sensitivity | 5mV |
| | 2. Low sensitivity | 50mV |
| Tape or T.V input sensitivity | | 100mV |

All inputs controlled by one 6-position functional switch Power switch on Volume Control

**TONE CONTROL:**

Separate Bass and Treble Controls giving 20db boost to 18db cut for both controls.
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10 Watt Ultra-linear with Ferguson O.P 301 Output transformer 6BQ5 output valves
Frequency response 30-20,000 cycles + or – 0.5db
Harmonic distortion better than 0.1 per cent.
Output impedance 15 ohms or as required.

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## NEW SEVEN-VALVE HI-FI CHASSIS

THIS NEW COMPACT DUAL WAVE SEVEN VALVE CHASSIS USES THE SAME TUNER CIRCUIT AS OUR 9 VALVE UNIT. WITH THE MULLARD TONE-CONTROL CIRCUIT GIVING SEPARATE BASS AND TREBLE CONTROLS. PUSH-PULL OUTPUT USING TWO OF THE NEW 6BM8 DUAL PURPOSE OUTPUT VALVES AND HEAVY DUTY M.S.P SPEAKER **£31/15/-** F.O.R. PACKING 10/- EXTRA.

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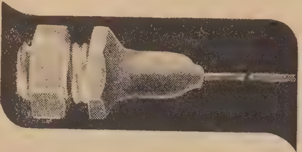
# Classic Radio

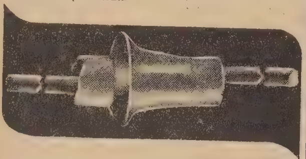
245 PARRAMATTA ROAD. HABERFIELD. N.S.W. PHONE UA2145

DUCON

# MINIATURISED RADIO & TV Components



TYPE CAE—Screw mounting stand-off variety in capacity ranges of 100 pf. min. to 3000 pf. max.



TYPE CAC 100—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units From 50 pf. min. to 1500 pf. max.

The disc ceramicon, with its short RF current path when soldered direct to the tube terminals, reduces the inductance to very small values

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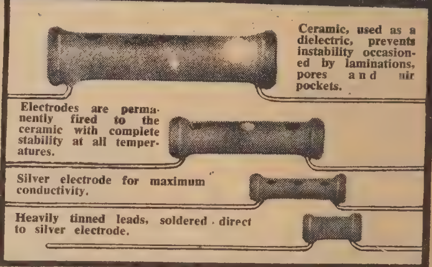
Type TV high voltage disc capacitors encased in "DURITE" for T.V., and other high voltage applications



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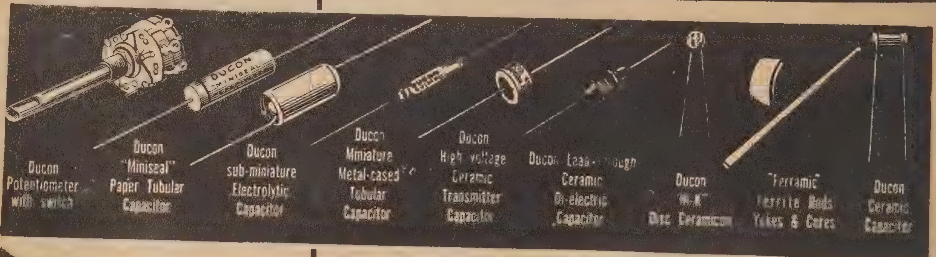
Silver electrode for maximum conductivity.

Heavily tinned leads, soldered direct to silver electrode.



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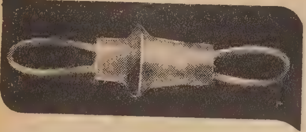
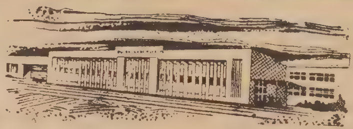


TYPE CAC—Feed-thru flange mounting type can be soldered direct to the chassis or shield plate in tuner units. From 50 pf. min. to 1500 pf. max.



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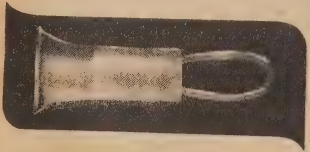

TYPE CAE 100—Stand-off flange mounting style mounted by soldering to the chassis. From 50 pf. min. to 1500 pf max.

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# NEWS AND VIEWS OF THE MONTH

## Rockets study the sun

THE U.S. Navy said it would launch the International Geophysical Year rocket program on July 1 with a series of firings to study eruptions on the sun.

Fourteen firings are scheduled from San Nicolas Island, offshore from the Navy's air missile test centre, and each will be dependent upon appropriate weather.

The geophysical year is an 18-month period during which scientists of 62 nations will conduct experiments and studies to learn more about the earth and the universe.

The Southern California rocket firings, to continue for two or three months, will study the tremendous eruptions near sunspots. These so-called flares interfere with radio broadcasts.

The rockets, combinations of a Deacon rocket and a Nike booster, are designed to carry ultra-violet and X-ray detectors 80 miles high and transmit telemetered data back to earth for a three-minute period.

## Flat TV screens

FLAT television screens, which hang on a wall like a picture, were demonstrated recently in New York.

The makers displayed a series of flat glass panels, each one-eighth of an inch thick, on which images were reproduced by electrical and optical signals.

Company spokesmen say the big advantage of flat TV is that it takes up much less space than a receiver using conventional cathode ray tubes.

They showed a small central receiver about the size of a table radio, which can be placed anywhere in a house.

Wires connect it to thin panels.

Flat wall TV, however, is not coming on the market in the near future.

Executives explained that the present glass panels are laboratory devices and much developmental work must still be done.

"But flat wall TV is possible in four or five years and a few million dollars from now," one said.

## Aborigines and cold

A CANADIAN biologist will spend the next two months in remote Central Australia trying to learn whether Australian aborigines can make it easier for Canadians to live and work in the frigid Canadian north.

Dr. J. S. Hart, 41, head of the animal physiology section of the Division of Applied Biology of the National Research Council, will make the study as a member of an international anthropological expedition.

The team also includes biologists from the U.S., Sweden and Norway.

They will live with the aborigines for two months trying to learn how natives can live naked throughout the year, even in below-freezing weather.

An official said the aborigines' ability to sleep naked on the ground in below-zero weather was "amazing."

## Atomic gas mask

SCIENTISTS have developed an Atomic Age facemask to protect soldiers against inhaling radio-active fall-

## POPULAR SCIENCE QUIZ

*Q: We have heard a great deal about the need to conserve water. With the vast oceans of the world available, why can't fresh water be made from salt?*

**A.:** Fresh water can be made from salt and, in fact, this is often done by various means. The difficulty is that the amount of energy required is too great to be practical in many cases.

By common definition, fresh water is defined as having less than 1,000 parts per million of dissolved salts, although for drinking, it is desirable that only half this amount of dissolved salt be present.

The salinity of ocean water varies according to the part of the world, but averages about 35,000 parts per million. In the Baltic Sea it is only about 7,000 parts per million, while in the Persian Gulf it is nearly 40,000 parts per million.

*Q: What are the dissolved salts?*

**A.:** The substance we normally refer to as salt, common salt or sodium chloride, accounts for most of the saltiness of sea water, but there are some 44 dissolved elements in all. Strange as it may appear, gold appears in sea water at the concentration of about 0.00.006 parts per million.

Taking the total concentration as 35 parts per million, the principal substances dissolved are as follows:

Sodium Chloride ($NaCl$)—27,213.
Magnesium Chloride ($MgCl_2$)—3,807.
Magnesium Sulphate ($MgSO_4$)—1,658.
Calcium Sulphate ($CaSO_4$)—1,260.
Calcium Carbonate ($CaCO_3$)—123
Magnesium Bromide ($MgBr_2$)—76.

where the concentrations are expressed as parts per million.

*Q: How can these dissolved salts be removed?*

**A.:** The obvious way is to evaporate the water in a still. Heat is applied, pure water evaporates and then can be condensed by cooling, leaving the salts. For a simple still it requires about 2,800 kilowatt hours of energy (in the form of heat) for each 1,000 gallons of water. This is a large amount of energy.

Some of the more efficient processes now being developed, it is hoped, will enable this to be reduced to about 10 or 15 kilowatt hours per 1,000 gallons when making fresh water from sea water may become a practical proposition.

*Q: What are some of the more efficient methods of making fresh water from sea water?*

**A.:** An idea first patented by a Frenchman, Pierre Pelletan, in 1840, enables the energy required for 1,000 gallons of water to be reduced from 2,800 kilowatt hours per 1,000 gallons to about 200 kilowatt hours per 1,000 gallons of water.

It is called "compression distillation," and involves carrying out the distillation at a pressure above atmospheric pressure when a higher temperature will be required to make the water evaporate. A following stage at lower pressure can be used when the water will evaporate at a lower temperature, enabling some of the heat from the previous stage to be used. A practical installation may use a number of these stages in series so that a large part of the heat supplied can be put to use.

The idea of using the "free" energy from the sun has received investigation, and a number of practical systems to make use of this source has been devised.

Yet another method involves the use of pressure and a special membrane which is permeable to water but not to salt. The salty water is placed in a container fitted with this membrane, and a pressure greater than the osmotic pressure between sea water and fresh water applied. This is approximately 350lb per square inch.

It has been demonstrated that with membranes made of cellulose acetate, 90 to 95 p.c. of the salt can be removed from the water in one pass.

Other interesting processes, still in the developmental stage, involve separation of the salts from water by freezing. Also, work has been done along the lines of dissolving salt water in organic solvents which do not dissolve salts.

The ion-exchange process uses resins or other material where the ions are unobjectionable, to replace the salt ions, and therefore is useful for softening water for many industrial processes.

The production of pure water from sea water in large quantities at low cost is an extremely important matter in many parts of the world, and extensive research will certainly be continued until a satisfactory method is found.

# This is the WORLD'S FINEST MAGNETIC RECORDING TAPE

# EMITAPE

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As used by the leading Broadcasting Organisations and for the recordings by:

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**EMITAPE "88"**
General-purpose tape available on spool sizes from 3" to 7" diameter.

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Long play—thin-based tape, giving 50% increased recording time on same spool range.

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out particles.

The lightweight mask, now undergoing final tests, is designed to give complete protection against war gases, germ welfare and fall-out particles.

But it will not protect the wearer against direct radiation.

The mask was developed by the Army Chemical Corps and a mine safety appliance company in Pittsburgh.

Instead of having the standard protruding canister used in World War II gasmasks, the new device has pliable gas-aerosol filters moulded into the rubber facepiece.

The mask provides easier breathing, better vision, improved speech transmission, and greater comfort.

## Safer cigarettes

FRENCH scientists claim to have developed cigarettes free of the agents which are believed to cause lung cancer.

They treat the tobacco and cigarette paper with chemicals to neutralise these agents.

Dr. Raymond Labarjet, a cancer expert, and a team of scientists from a State-owned tobacco firm believe France will have the first "cancer-free" cigarette on the market.

Using robot smokers, the scientists found that cigarette paper was more liable to lead to cancer than tobacco.

They found they could cancel out dangerous tars by treating the paper with ammonium sulphide and the tobacco with nitrogen compounds. — U.P.

## Homework and TV

FRENCH schoolchildren who watch television do better homework, according to the results of an inquiry.

Children know exactly what they wish to see on television.

Of 200 boys and girls over 14 questioned, the Association of Research Studies said 49 per cent stated they liked interviews, newsreels and documentary shorts.

Seventeen per cent liked films, 16 per cent variety shows, 9 per cent sports, 5 per cent plays, 3 per cent circus, and 1 per cent concert music.

Schoolteachers were in favour of television.

They noted that homework was better done by children who watched TV than others who did not.

## Mont Blanc power

THE famous glacier on Mont Blanc known to tourists as the Mer de Glace, is soon to be harnessed to provide hydro-electric power for France.

The scenic beauties of the region, however, will remain unspoiled, since all constructions are to be underground.

According to recently announced plans, the river flowing beneath the glacier will be tapped at an altitude of 4,700 feet.

The water will be drawn off through a tunnel over a mile long to a point where high pressure pipes will carry it down a sharp drop of some 1,200 feet to an underground power station in the valley of Chamonix.

A similar scheme has been worked out for the glacier of Argentiere, on the other side of Mont Blanc.

Electric power produced through this scheme is expected eventually to reach hundreds of millions of kilowatts a year.

LINEAR AMP
V2
TELEVISION CALIBRATOR
TYPE No A56057
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CRYSTAL-CALIBRATED MARKER GENERATOR

A56057

**This T.V. calibrator provides reference signals of crystal accuracy as an aid to a wide range of radio servicing, design or developmental work.**

GENERAL FEATURES

- R.F. coverage 19-260 Mc/s fundamental frequencies in two continuously tunable ranges.
- The tuning dial of spiral shape has effective length of 72 inches.
- 2.5 Mc crystal provides check points over full frequency range.
- Crystal mixer and audio circuit enables unit to be used as hetrodyne frequency meter.

*when used for TV work*

- **5.5. Mc crystal aids i.f. alignment.**
- **Special modulation enables production of horizontal and vertical bars on T.V. screen.**
- **Equipment may be modulated with video or r.f. signals.**

*For further particulars contact*

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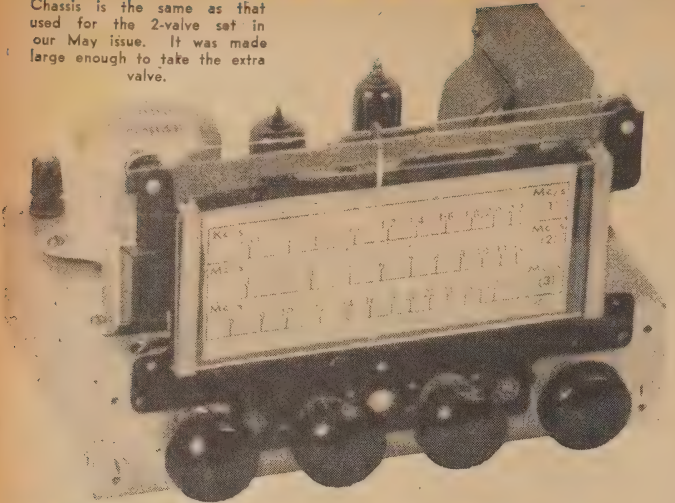


Chassis is the same as that used for the 2-valve set in our May issue. It was made large enough to take the extra valve.

# The 1957 3-Band Three Valve Receiver

In our May issue we described a small set using the two-in-one 6U8 valve. Small and simple as this set was, it gave excellent results even on loudspeaker. In this our latest version, the addition of an audio stage will ensure adequate room volume and extend its usefulness on all three bands.

SMALL sets have always had a place in the scheme of things, a fact made abundantly clear by the popularity of the variety we have described in the past. A large number of circuit designs have been evolved, most of them aiming at economy and simplicity, and the simple receiver for three bands, described in the May issue, was no exception.

Economy was achieved by the use of a two-in-one valve, although some circuit simplicity was sacrificed by the use of band switching. However, the ease of manipulation was considered to be of prime importance, since the set was intended for rack or cabinet mounting

## GOOD PERFORMER

Given a reasonable length of aerial, this set was capable of bringing in the more powerful overseas stations, while, with a few feet of wire on the floor, sufficient power was available to operate a speaker on the local stations.

While quite adequate in many cases, we felt that the addition of an extra audio stage would be a worthwhile improvement. A number of letters in the mail expressing a similar feeling resulted n the present version of this set.

It will be noted that the circuits are almost identical, the main differences eing in the additional audio stage and he filtering and decoupling circuits. The triode section of the 6U8 has been altered to a voltage amplifier with the appropriate alterations to the bias resistor and the plate load.

For those not familiar with the principles of reaction, a few words may not be out of place. Briefly, it consists of feeding back some amplified R.F. signal into the input. The amount of energy fed back is carefully adjusted and may make up for the deficiencies of a tuned circuit, improving the selectivity and increasing the amplification.

Too much feedback will cause oscillation and the detector will produce a radio frequency of its own which, when it beats with an incoming carrier signal, will produce the characteristic squeal or howl of the regenerative detector.

This tendency for the detector to oscillate with excessive feedback may not always be undesirable, for, if allowed to oscillate weakly, it will allow the reception of Morse code stations. The beat note produced obviates the need for a beat oscillator as is normally fitted in the more elaborate receivers.

### by Wes Yashin

A special calibrated card is available for the dial—see block on page 37.

A type 6U8 valve is used as the detector and first audio. A pentode and a triode are combined in the one envelope, both sections having good performance figures even when compared with single valves of the same type.

The pentode section is connected as a leaky grid detector, while the triode section is a voltage amplifier to provide the gain and the drive for the output stage.

## REGENERATION

Feedback for the regenerative circuit is obtained by placing a tap in the grid winding and returning the cathode to this point. This method has the advantage that a single tapped coil is required and regeneration may be controlled by varying the voltage on the screen of the pentode.

Since the gain of the pentode section as an audio amplifier is intimately connected with the screen voltage, and the screen voltage governs the point at which the valve will go into oscillation, the placement of the tap on the grid winding is important in deciding the screen voltage which will bring about this condition.

It should be possible to select a position for the tap on the grid winding, at which the screen voltage and consequently the audio gain is as high as possible without exceeding the peak gain value and the consequent sudden drop in gain.

The triode section is connected as a voltage amplifier, differing from the earlier circuit in the values of bias resistor and plate load. A volume control in the grid circuit allows the optimum position of the reaction control to be used at all times, thus retaining maximum selectivity.

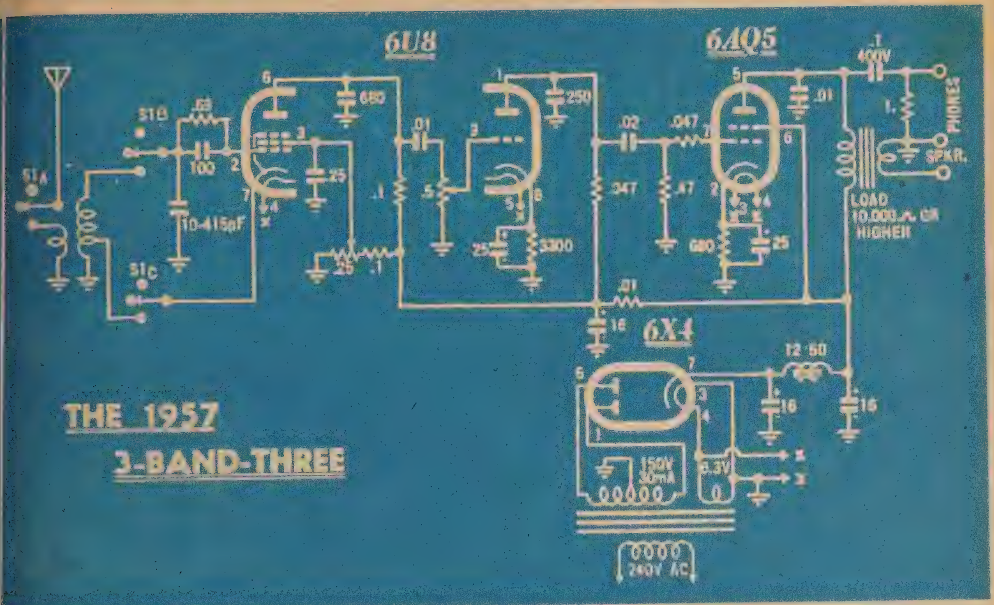
Due to the high audio gain of the set it was desirable to introduce decoupling to the first two stages. With the values specified, there should not be the slightest trace of hum even on headphones with the gain full on and no signal.

## OUTPUT STAGE

The final stage is a conventional power output stage and needs little elaborating. The maximum power output is just over half a watt, giving useful room volume from a loudspeaker. For greater effective amplification, the alternate use of headphones is provided for. In this position the headphones are connected between the output plate and ground through a capacitor.

Readers who have low impedance

# CIRCUIT DIAGRAM OF THE NEW 3-BAND RECEIVER



The circuit is quite simple, but the extra stage gives good speaker results.

:dphones may connect them across the ce coil winding of the output transmer. The load presented to the valve l not be optimum but will give good n, which is all that matters.

The resistor connected across the one terminals is to prevent the coupg capacitor discharging and thus plac- the terminal at the potential of the :put plate. The resistor ensures that : capacitor is charged and that the C. potential of the terminal is at chas- level. The power supply needs little nment, being quite standard.

A frequent query with sets of this e concerns the use of a power transmer with secondary voltages higher an specified. This is in order provided final high tension is kept around the ure recommended for the particular sign.

## ROPPING RESISTOR

The obvious way in which to get rid excess volts is to introduce a dropping sistor in the high tension line. A good ace for this is between the rectifier and first filter capacitor. A resistor in s position will limit the peak output om the rectifier, making it easier for rectifier and the first filter capacitor. Calculating the dropping resistor reires a working knowledge of Ohm's w, which all radio enthusiasts should ssess. The value of dropping resistor, en used directly after the cathode the rectifier, is somewhat lower, but optimum value may be arrived at by al and error.

The chassis used was the same as specid for the original set and no difficulty ould be encountered in the fitting of e extra components since adequate space is available. The USL/37 dial was retained, and art paper calibrations will still be available through the query service. Those who have constructed the original set need no alterations to the front end.

For those who are starting from scratch, it will be necessary to take the dial to pieces and re-assemble it to fit the requirements of the set. The control spindle should be moved from left to right and mounted on the chassis, using a countersunk bolt in the inside hole of the spindle bracket to clear the dial plate.

The dial mechanism is held by two 1-8in bolts and the retaining nuts of the switch and potentiometer spindles.

The under-chassis photograph clearly demonstrates the wiring layout with the additional components. Point-to-point wiring was used, and most of the components suspended by their pigtails.

The 6U8 is mounted with a gap in the pins facing the upper left side corner of the chassis. A three- and a two-lug mounting strip are mounted under socket retaining bolts to the left and the right of the socket respectively. The three-lug strip is an anchor point for the plate loads of both the triode and pentode sections of the 6U8 and the .01 decoupling resistor and its bypass electrolytic.

The output valve grid leak is anchored between the lugs of the two-lug strip.

## PARTS LIST

1 Chassis 8x5x1⅞ inches.
1 Panel, 9x5⅝ inches.
1 USL/37 dial.
1 Roblan single gang. (10-415 pf)
1 3x3 single deck switch.
1 150/30 power transformer.
1 12/50 choke.
1 Speaker transformer (10,000 ohms or higher).
1 Noval socket.
2 Miniature 7-pin sockets.

### VALVES

1 6U8, 1 6AQ5, 16X4.

### CAPACITORS

3 16 mfd 350 volt electrolytics.
2 25 mfd 40 volt electrolytics.
1 .25 mfd 400 volt paper.
1 .1mfd 400 volt paper.
1 .02 mfd 400 volt paper.
2 .01 mfd 400 volt paper.
1 680 pf ceramic.
1 250 pf mica or ceramic.
1 100 pf mica or ceramic.

### RESISTORS

1 .68 meg ½ watt.
1 .47 meg ½ watt.
2 .1 meg ½ watt.
2 .047 meg ½ watt.
1 .01 meg ½ watt.
1 3300 ohm ½ watt.
1 680 ohm 1 watt.
1 .25 meg pot.
1 .5 meg pot

### SUNDRIES

4 knobs, 5 terminals, 1 4-lug strip, 2 3-lug strips, 1 2-lug strip, materials for coils, hookup wire, solder, flex, power plug, nuts & bolts.

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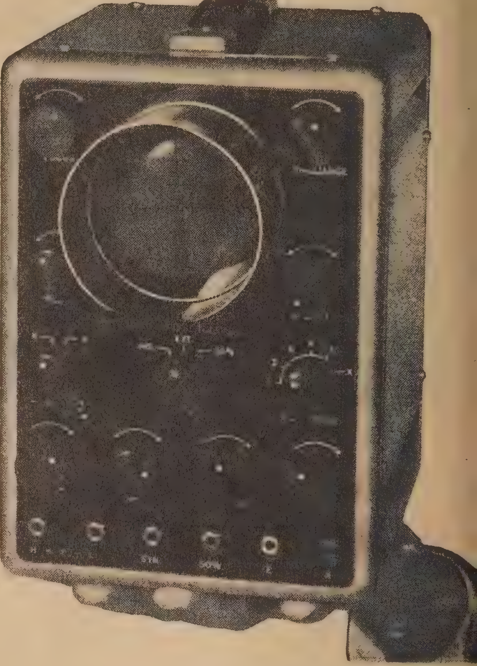
# ELECTRONICS

# MODEL TV-1 OSCILLOSCOPE



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**Vertical Amplifier:** 2 position switch for choice of gain/bandwidth conditions. Push-pull amplifier gives a symmetrical undistorted picture.

"N" position . . .

sensitivity 50 mV/Cm. D.C. to 100 Kc/S. (—3db).

"W" position . . .

sensitivity 500 mV/Cm. 20 c/s to 3Mc/S. (—6db).

Deflection is not limited in the "N" position and the undistorted amplitude may be expanded to more than fill the screen. In the "W" position, the undistorted amplitude is limited to a height of 2 Cm (¾") which is quite adequate for the examination of television pulses.

In addition to a gain control, alternative input sockets are provided, the "H" position utilising the total amplifier gain, with a D.C. input resistance of 0.5 megohms.

The "L" (low) gain position provides an attenuation of 20 times with a D.C. input resistance of 10 megohms and is frequency compensated.

**Horizontal Amplifier:** D.C. to 100 Kc/S. (—3db) with a maximum sensitivity of 70 mV/Cm and an input impedance of 1 megohm. A continuously variable gain control is fitted.

**Time Base:** In five ranges with continuously variable control provides sweep of from 5 c/s to 50 Kc/S. The time base is fed through the horizontal amplifier, so giving symmetrical deflection from zero to 5 screen diameters. Fly back is suppressed.

**Synchronisation:** Manual amplitude control.

**Miscellaneous:** All deflection plates and grid of C.R.T. are available for direct connection at the rear of the instrument. Direct coupled shift controls give instant spot shift.

**Power Supply:** The instrument is mains operated from 200–250 V. a.c. 50 c/s.

**Power Consumption:** Approximately 30 watts.

**Dimensions:** 6½" x 9" x 8".

**Weight:** 6½ lb. approximately.

**Current Price:** £65 0s. 0d., plus Sales Tax.

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3682

.O; end of the coupling capacitor and gr stopper attach to the hot end of this re tor.

further tag strip near the hole for th power lead supports the power leads at their junction to the transformer pr ary leads. A four-lug strip at the re of the rectifier socket supports most of e power supply wiring, including the fil components.

he order of wiring may be arranged to uit individual tastes, but we have fo d that a methodical approach leaves lit chance for errors and omissions C mence with the wiring involving e s such as the heater wiring, the transo er and H.T. leads, and so on. The y power supply components may be wi d in next, followed by the remaining c ponents working either from output o put or vice versa. Do not omit tc a h the centre spigot of the valve so ets, since this acts as a shield e veen pins.

/iring of the switch may prove tricky o some readers. However, taking it one e ion at a time, it should not be to li cult. Each section has three position a each section is used for the same c uit with regards to the windings of h three coils. For example, the movin a of the grid section connects to th u tion of grid leak and tuning capaci o selecting the hot ends of the gri v dings on the three coils.

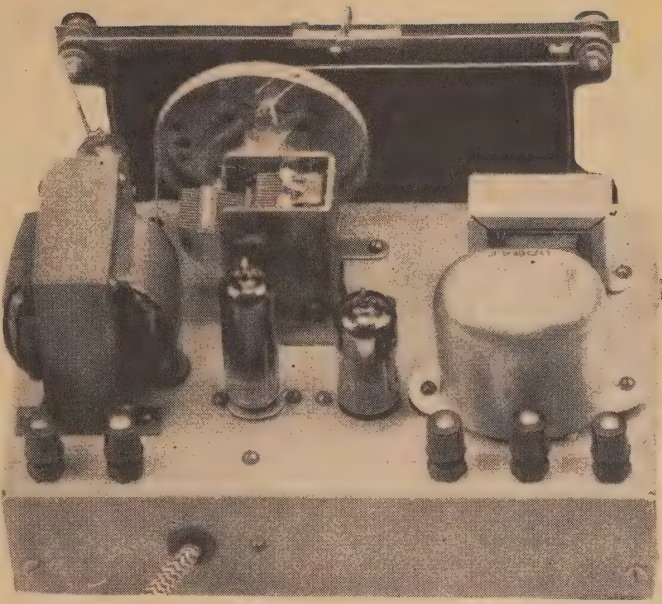
ikewise the moving arm connected to h cathode of the pentode section selects h taps on each of the three coils and h moving arm connected to the aerial ects the aerial winding of each coil

)ccasional twiddling of the switch in h right order of rotation, while wiring s uld assist in distinguishing the various o itions.

'or those possessing a multimeter and v hing to check the performance of the e here are some voltage and current i res as measured with an ordinary 1 )0 o.p.v. meter. The total current d in should be in the vicinity of 25 r ls, varying from about 22 mills with signal to about 24 with maximum s nal.

he input to filter will be 170 volts v le at the output of the filter there s uld be about 160 volts, being the e uired H.T. The reading from plate c athode of the output valve should be a ut 145 volts, while from screen to c hode there should be 150 volts C hode current, i.e., the combined plate a screen currents, for the output valve s uld be about 20 mills, while the bias s 11 volts.

# REAR VIEW SHOWS COMPONENTS



Power transformer is at the left, speaker transformer at the right

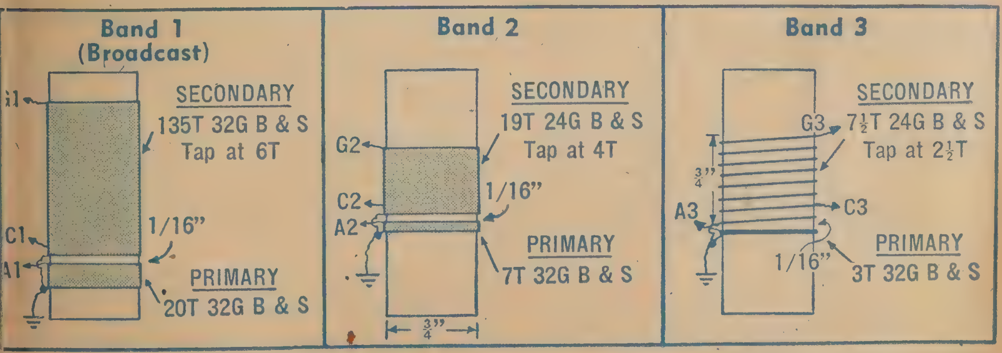
We have not mentioned the coil-winding details, since these would in most cases be tackled last. Bakelised paper formers, about ¾in in diameter, are required. Each former will have to be exactly 1¾in long, particularly for the broadcast band, in which case there is just sufficient room to wind the coil. allowing for the depth in chassis.

To hold the shortwave formers to the chassis we made two diagonally opposite cuts in the former, through which we passed strips of aluminium. These strips may be drilled and tapped or just drilled to take the retaining bolts which anchor them to the chassis.

In the case of the broadcast coil, a good deal of juggling will be required to succeed with the above method of mounting. We have found that the simplest method is to cement a shallow wooden or polystyrene plug to the lower end of the former. A bolt through the centre of the plug will anchor the former to the chassis.

Once the coils have been wired in, you will probably be very anxious to switch the set on. Leaving the rectifier out, plug the remaining valves and switch the power on. The cathodes should now glow a dull red, but there should not be any signs of heating elsewhere.

Switch the set off, plug the rectifier in, and switch the power on once again, keeping your hand on the switch—just in case. If all is well, some signs of life should be noted on turning the volume



These drawings will help you to make up the coils.

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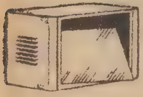

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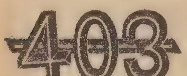

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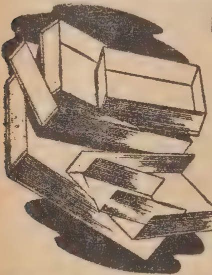

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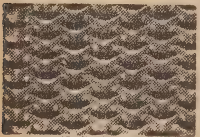

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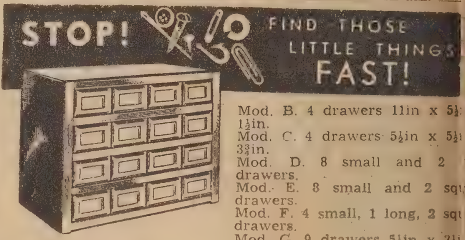

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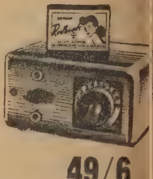

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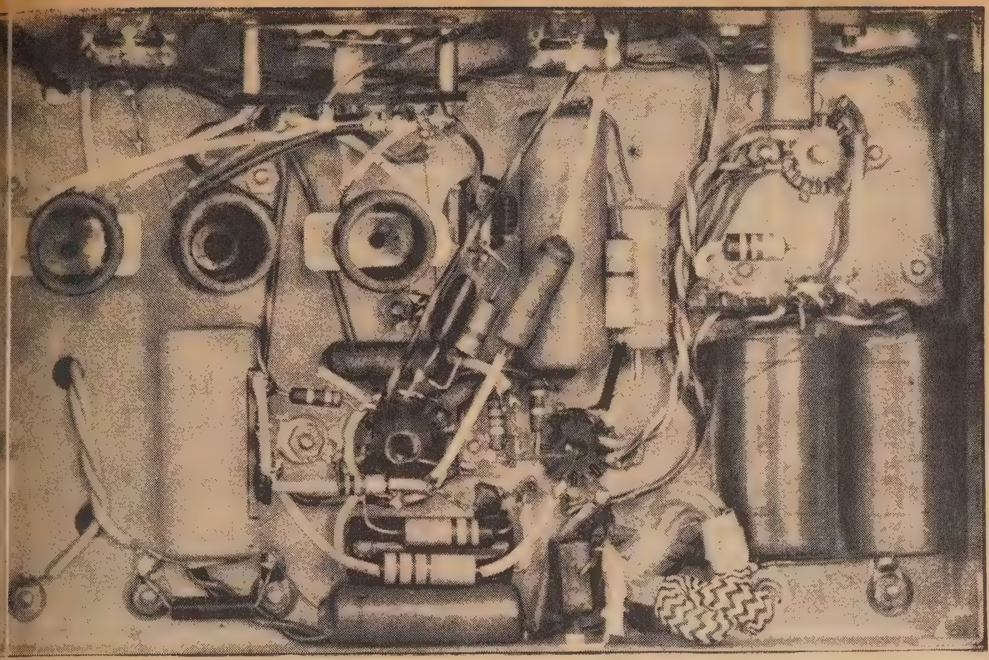


Almost every component beneath the chassis can be seen from this picture.

regeneration up. Connecting an al should bring in stations varying in ngth with the length of aerial used. e the length of aerial has some effect the tuned circuit, a series capacitor small value may be desirable with aerials to minimise the loading ts of the aerial on the tuned circuit.

n the broadcast band, adequate selec- y and signal strength was obtained only several feet of wire on the r, in an average locality.

aving completed all the preliminaries, can settle down to many hours of yable listening—a rewarding experi- e for the efforts in putting a few com- ents together.

## OIL WINDING

few notes on coil winding and ad- ments may be of benefit to those are building a regenerative set for first time.

xact coil requirements for any in- dual set are to some extent affected associated components and reception ditions. Although the specifications gave are for an average set of con- ons some improvement to the per- nance may be achieved a little experimenting. hould a receiver prove unselective, try the ct of reducing the number of turns on the primary winding and/or increasing the spacing between primary and secondary. Should the opposite effect be desired reverse the procedure.

Regeneration which is too sudden may be tamed by placing the cathode tap lower on the grid winding. Should regeneration fall away on the low frequency end of the band, placing the tap higher on the grid winding should cure this fault.

The coils in this receiver were designed for three bands, the first to cover from about 600 Kc to about 2.2 Mc, the second from about 3 Mc to 12 Mc and the third from about 8 Mc to 30 Mc. Should you require it, the coils may be made to tune slightly higher or lower simply by removing or adding turns to the tuned grid winding.

As mentioned earlier, a calibrated and paper dial scale is available through the query service. This scale is intended for mounting on the dial frame behind the pointer and requires the removal of the existing calibrations on the glass. Its use however, presupposes the coils and tuning capacitor to be identical with our specifications.

Should the coils and capacitor vary or should you desire to do it yourself, here is no reason why an accurate set of calibrations should not be made with the aid of a service oscillator.

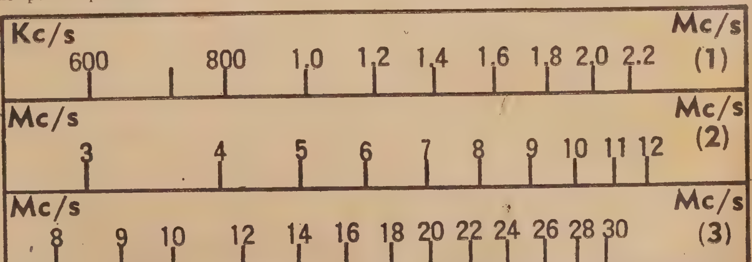
Since there are no tuned circuits to adjust, calibration simply consists of tuning the receiver to correspond to a setting on the oscillator and marking this frequency on the dial.

## OPTIONAL PANEL

The final appearance and mounting of the set are best left to the individual choice of the reader. A panel was specified for the original set but this has been made optional in the present version simply because some may prefer to mount the set directly behind the wooden panel of a cabinet while others would require a metal panel for rack mounting in the workshop.

Dial lamps are not shown in the photographs but may be easily added if desired. Some 150/30 power transformers may have a separate 5 volt winding and the dial lamps may be connected to this winding.

☆



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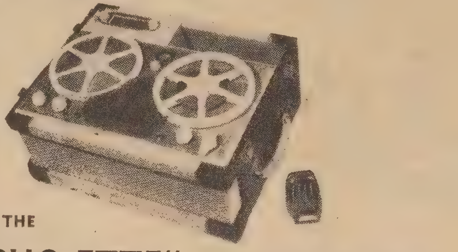

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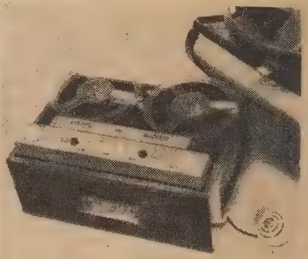

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# NEW BOOKS

**R.C.A. RECEIVING TUBE MANUAL (Technical Series RC-18), Tube Division, Radio Corporation of America, Harrison, N.J., 8 3-8i by 5 3-8in, soft cover, 352 pages.**

The latest edition of an "old familiar" tains the general size and style of evious editions with revisions and ditions The first 65 pages approx. is voted to valve fundamentals which ads on to information on valve in rmation and guidance on the inter etation of valve data. This part of e manual is almost a textbook in its vn right and, we consider, one of the ost valuable features.

There follows data on more than 5 receiving valve types current with .C.A. Many of these types are, of ourse, also current with many other lve companies throughout the world

For the less popular valves the socket nnections plus a brief description is ven while expanded data, curves and pical operating conditions are given for ose types in more general use.

## V PICTURE TUBES

A television picture tube characteris cs chart giving brief data on current .C.A. picture tubes occupies some six ages.

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* * *

**R.C.A. TRANSMITTING TUBE MANUAL (Technical Manual TT-4), Tube Division, Radio Corporation of America, Harrison, N.J., 8 3-8in by 5 3-8in, soft cover, 256 pages.**

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**TRANSISTORS, Circuits and Servicing, by B. R. A. Bettridge. A. M. Britt. I.R.E. Published for the Wireless and Electrical Trader by the Trader Publishing Co., May, 1957, 23 pages. 8¾in by 6in. soft cover.**

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# FROM THE SERVICEMAN WHO TELLS

**When is a set too old to repair economically? This may be a hard question to answer, but one I had this month must surely be a borderline case. At the other extreme I was faced with a 16 mm projector suffering from a puzzling "slow fade" but which turned out to be quite simple after all.**

RST, however, in the absence of any worth-while T.V. faults, I can at relate some interesting incidents. des being mildly amusing, they surely onstrate just how tangled up the age citizen can become, particularly n, as I suspect, his only source of wledge is the average T.V. salesman.

he first is a little sidelight on the ost endless controversy on T.V. en sizes, a controversy which, inci- ally, has led to some pretty acri- ious discussions between the adher- n to the two most popular sizes, the nch and the 21-inch.

ersonally, I try to keep out of such ussions, at least during business rs, and confine my comments to cor- ng grossly erroneous ideas and sup- ng such facts as may help a custo- to make his own decision.

## HAT IS IDEAL?

any case, any discussion on what in "ideal" size would seem to be ut as pointless as trying to pin down "ideal" car, an "ideal" house, or even "ideal" pretty girl! Personal ideas requirements are so varied that no design of anything can possibly suit yone.

et it is quite surprising the number times I am asked to nominate the t" size screen; something I steer r of, at least until I have some idea the size of room involved and the able viewing habits.

qually surprising are some of the neous ideas. One woman asked me, all seriousness, whether it was true a 17-inch set would not be suit- for receiving color T.V. transmis- s—assuming that these were likely to tuate in the near future. Someone, emed, had advised her most empha- lly that this was so and that it would refore be unwise to invest in a 17- set.

## DIFFERENCE

assured her that (1) a 17-inch set just as capable of receiving a com- ble color transmission as any other, (2) that there was little likelihood of problem worrying her in the imme- e future. Since a 17-inch set seemed suit her requirements in all other pects, she was grateful to have this doubt removed.

nother housewife came up with an better one. It concerned a distant tion of hers who, in spite of the fact he now lives within range of our . system, is a typical country type has spent all his life in the "bush."

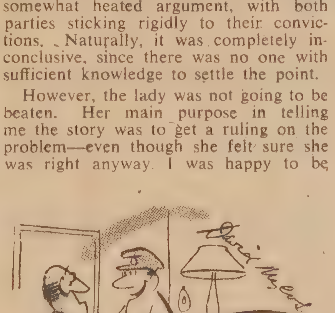
uring a recent visit to the city (it's than 50 miles, yet he still "visits" city in traditional style) he an- nced his intention of buying a T.V and was most emphatic that it was ng to be a 21-inch type. In fact, he nt to considerable trouble to point out all the disadvantages of the 17-inch varieties, in spite of the fact that his host—my customer—had already invested in one of the latter.

His crowning faux pas was when he used his host's set to demonstrate one of these points. "See that!" he exclaimed, pointing to a sporting scene in which the cameraman had inadvertently "amputated" the feet of the contestants. "That wouldn't happen on a 21-inch set. You'd be able to see the bloke's feet properly. You lose half the picture on these little screens."

## AN ARGUMENT

This was too much for his host. Unable to contain herself any longer, she immediately queried the accuracy of his statement. The result was a long and somewhat heated argument, with both parties sticking rigidly to their convictions. Naturally, it was completely inconclusive, since there was no one with sufficient knowledge to settle the point.

However, the lady was not going to be beaten. Her main purpose in telling me the story was to get a ruling on the problem—even though she felt sure she was right anyway. I was happy to be able to confirm this and also explain, in simple language, why it was so.



"Now—are you sure you haven't been trying to fix it yourself?"

Thus fortified, she announced her intention of going forth to battle once more. And, judging by the glint in her eye, I began to feel almost sorry for the country cousin!

Finally, there was an incident concerning a T.V. aerial. A casual business acquaintance approached me for some advice concerning his particular problem and, even though it was outside business hours and would not afford me any direct remuneration, I said I would be happy to help him if I could.

[Quite apart from any charitable inclinations on my part, I did not overlook the fact that his position in the community would make him an excellent advertising agent—even if he was unaware of his role.]

It seemed that he had recently acquired a T.V. set and was operating it from a simple indoor aerial sitting on top of his receiver. His location was such that he received plenty of signal strength and virtually no ghosting from both Channel 7 and Channel 9.

His only complaint concerned Channel 2, which was markedly weaker than the others and marred by "snow." At the same time, he felt that this was probably only a temporary condition, due to the limited power and aerial height of this transmitter, while awaiting the erection of their tower.

## SIMPLE AERIAL

For this reason he hesitated to go to the trouble and expense of fitting an elaborate outdoor aerial which, he felt, would be quite unnecessary in a few months' time. Could I suggest something simple he could use to improve the performance of Channel 2 in the meantime?

I said I thought something could probably be done, and set about explaining how to make a simple ribbon folded dipole, roughly resonant on Channel 2, and which I suggested he mount under the tiled roof of his house.

When I started to explain the nature and general appearance of 300 ohm ribbon, I was surprised to discover that he seemed to be better acquainted with this material than I had expected. In the circumstances, I wasted no more time on this, going straight on to describe how to make the aerial.

I suggested that he start with a length of ribbon about 7ft long (I couldn't remember the exact number of inches, but said I would tell him later), short circuit each end, then cut one of the conductors in the middle to form a take-off point for the signal. From here, another length of ribbon would be used to convey the signal to the set in the usual way.

## ROUGH SKETCH

I drew a rough diagram on the back of an old envelope, then went on to explain how the di-pole section could be fastened to the rafters with cord to keep it taut. Finally, I mentioned a few points about correct orientation. Whereupon my friend expressed his gratitude, and we went our respective ways. I felt I had done my good deed for the day.

A week or so later I met him again.

"Well," I inquired, "how's the T.V. aerial working out?"

"No good, I'm afraid," he replied, with evident disappointment. "In fact, it didn't work as well as the one I had."

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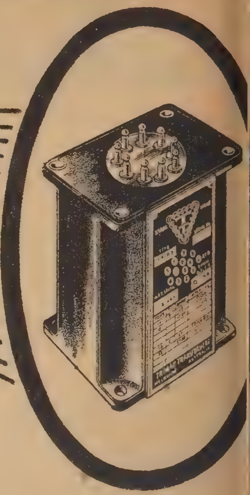

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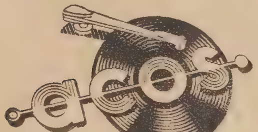

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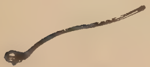

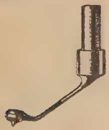

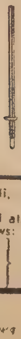

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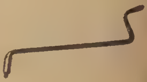

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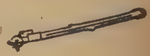

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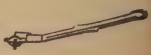

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Since this just didn't make sense, I ssed for further details. Had he con- ucted it as I described? Had he used correct type of ribbon? And so on.

In particular I wanted to know about ribbon. What kind of ribbon was

"Oh, just ordinary twin ribbon."

Where had he bought it?

"Woolworths," came the rather sur- sing reply.

"Woolworths!" I exclaimed. Now I s sure something was wrong. Wool- rths, with all due respect to that rthy retailing organisation, has not, yet, reached the stage of selling 300 m twin-feeder ribbon.

It was now obvious what had hap- ned. To my friend, all twin cable was ke, and he had simply purchased sev- l yards of twin plastic lighting flex. far as I have been able to determine natural impedance of this is nearer 0 ohms than 300.

## LONG WAY OUT

But that was not all. Further question- ig elicited the fact that the length of aerial portion was quite random. Ad- ttedly, I might have sounded a trifle gue in suggesting "about seven feet," t he was even more vague about my gueness—if you get what I mean.

To cap it all, he couldn't be quite re whether he had even connected the tion of ribbon as I had prescribed. pparently the old broadcast band- bit of using any odd piece of wire dies ry hard.) The final result must have en just about as far from optimum as e could get.

I'm afraid it's all very discouraging.

Reverting to conventional radio re- ivers my first case concerns a rather cient mantel set. It belonged to a dow whose financial circumstances re such that she was obviously not xious to spend a great deal of money it. In fact, when she brought it into shop she suggested—probably as a sult of wishful thinking—that there was . . . just some little thing wrong with "

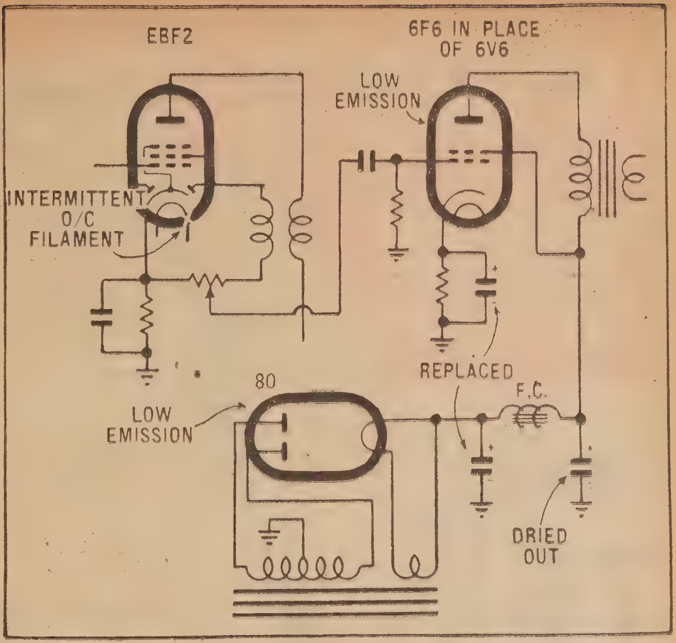
The model was one which, as nearly I can remember, first made its appear- ce about 1940, though this particular t may have been a slightly later ver- on. Prior to this it had been a simple ur-valve broadcast mantel receiver, til someone conceived the bright idea producing a dual-wave version.

## COMPROMISE

Since it had never been intended for ch a role there was very little room to ount the extra coils and no place to fit wave-change knob. The problem was ercome by mounting the coil bracket top of the gang and locating the knob the rear of the cabinet, but the final sult always looked exactly what it was -very much a compromise.

With the set still in the cabinet I itched it on and tuned it over the nd. It was just about as weak as a t can be (and still work), as well as ving the most atrocious distortion in e output. I didn't think much of the ances of it being a "little thing."

Next I commenced to take the chassis t of the cabinet. This proved to be ite a job and for a rather unusual ason. The chassis was held in place four bolts passing through the bottom of the cabinet and, as is customary, these were also used to secure four rubber feet.



These alterations fixed an old set which had a collection of faults.

At least they had been rubber feet once. With the passing of time the rubber had undergone many chemical changes and slowly deteriorated into a gooey mess. When this had first happened the owner had apparently noticed that the feet were marking the furniture and had placed a sheet of paper under the set.

## PAPER "FEET"

Later still it was noticed that the rubber had penetrated the paper and a fresh sheet was supplied; only to meet the same fate a few months later. Thus it was that I was faced with a now-hardened lump of rubber-cum-paper which completely enveloped the head of each bolt. And, believe me, it was really messy.

I hacked and pried at it with a variety of tools, such as screwdrivers, sidecutters, etc., finally settling for a discarded carpenter's chisel. It wasn't particularly sharp—for a chisel—but it did cut the mess away better than anything else.

Eventually I was able to expose the head of each bolt, clean out the recess and finally unscrewed it. Then I slipped the chassis out of the cabinet—and the speaker fell out after it.

Investigation showed that the speaker had been mounted on a cardboard baffle by means of four screws, while the baffle had been fastened to the cabinet by means of four clips. Of the four screws only one now remained, while the clips were loose and right out of position. As a result the only thing which kept the speaker in the cabinet was the chassis.

With the set on the bench I made a quick voltage check. The HT was around 250v, which seemed a trifle high, while the bias across the 6F6 bias resistor was only six, which was very definitely low.

It was while checking up on these voltages that I made another discovery. The 6F6 appeared to be a "foreigner," the stamping on the chassis clearly showing a 6V6. How or when this change had occurred I had no means of knowing, though I suspect it may have been a result of wartime shortages.

In fact, since the valve appeared to be of the same vintage as the 80, it is quite probable that this change was made at the factory. The two valves are sufficiently alike to allow this to be done without any changes to some circuits. The pin connections are identical, and the bias resistor often the same. To be sure, the load requirements are different, but this is more academic than real. Of rather more significance would be the reduced sensitivity, but even this would not be really serious.

## FACTORY SUBSTITUTE?

Remembering how things were during the war years, it is not hard to visualise a factory making such a substitute in order to clear a batch of chassis during a temporary shortage of 6V6s.

Reverting to the more immediate problem, I plugged the 6F6 in the tester and, as I expected, found it to be very sick. The 80 was in a similar condition and had only been able to deliver enough voltage to keep the remainder of the set going by reason of the weak 6F6.

I replaced both valves, using a 6V6 this time, and this immediately restored most of the lost sensitivity. However, the reproduction was still very thin and the audio stage "motor-boated" badly when the volume control was advanced.

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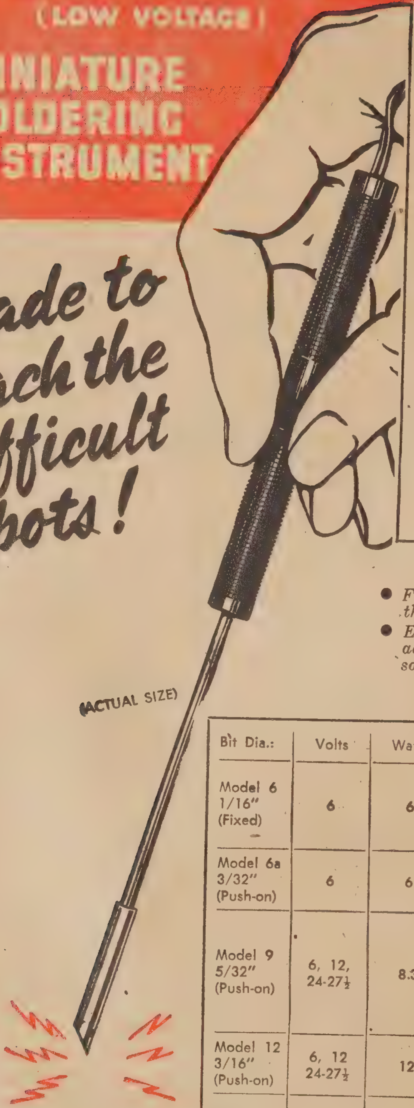

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oubt about the remaining ones. I had wish to involve the owner in more xpense than was absolutely necessary, t I felt obliged to replace any com-onent which might be in doubt. After l, it would cost a good deal more to place them at a later date, and they ere obviously as old as the faulty one.

I finally decided that I would do the st by the owner if I changed the others, cluding the 10 mfd on the 6V6 cathode sistor. The set was now performing asonably well, except that the short-ave section was completely dead. All ings considered, I thought it best to nore this, for it was obviously of no terest and would only involve unneces-ry expense.

## OISY CONTROL

The only other apparent fault was a isy volume control and, much as I gretted it, there seemed no way out replacing this also. I could only hope ere would be nothing more wrong.

But there was. While giving it a test n (on my favourite program) the lume commenced to drop slowly, entually fading away completely. After minute or so the signals slowly re-rned of their own accord. In the eantime, of course, I had pounced on e set and checked each valve heater; e most likely cause of such symptoms.

It turned out to be the EBF2 IF am-lifier/detector and I had visions of aving to replace this also. Fortunately, ere was a chance of salvaging it. A equent cause of such troubles is a ulty soldered joint in the base pin, the ad wires from inside the glass envelope eing of an alloy which needs careful eaning for effective soldering. (The odern "baseless" valves eliminate this eakness.)

The fault can usually be cured by the mple application of a hot soldering iron ith plenty of flux and solder. Fur-ermore, I have no compunction about sing some of the more potent paste uxes which one might be inclined to ondemn for other applications. After l, corrosion is not likely to be a prob-m in such circumstances, while the eed to make a good joint is most im-ortant.

## EEMED OKAY

This time it looked as though my cus-omer's luck had changed. After giving e base pins "the treatment" I gave the t a prolonged bench test, but could not duce the trouble again. I finally de-ided that it was cured.

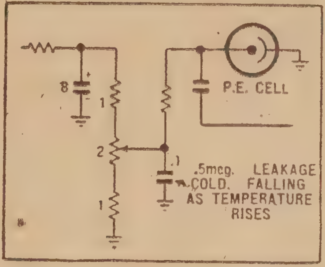
And that was about all I could do for e set, within reason, though I must dmit that I wasn't particularly happy bout it. The resistors were of a type—ow discontinued — which were never ery reliable, while most of the paper apacitors had bulged ends and badly racked sealing compound.

By rights, most of them should have een replaced, since any one could fail t any time. Yet I had to draw the line omewhere, and the owner was already ommitted for more than we had both oped. All I could do was return the et, detail what I had already done, and xplain that there was still a risk that ther sections might fail at any time. also pointed out that it was reaching e stage where servicing would become progressively less economical, and where a new set would be a better proposition.

Making a rapid change of scene, my next story is about a 16 mm sound system. This particular piece of equipment was not new to me, the owner being a friend as well as a customer, and we had tackled this particular piece of equipment together on more than one occasion.

This time he complained of a somewhat puzzling variation in sound sensitivity. He hastened to explain that this was something more than the variation between soundtracks—in itself a very wide one—or the inevitable variations in effective line voltage due to the need to use a 110 step-down transformer.

No, it was something less tangible than this: a gradual loss of gain which seemed to get worse the longer the equipment was run at any one session. Then, at the next session, it would be back to normal, at least at the start.



Temperature variations altered the insulation resistance of this condenser.

Fortunately, he was able to provide a very vital clue. It seemed that the loss could be compensated by adjustment of the P.E. cell voltage control, a form of auxiliary volume or sensitivity control. As its name suggests, it varied the voltage on the P.E. cell, being a 2 meg. pot. as part of a voltage divider across the main HT line.

This information was important, because there is a definite limit to the voltage which may be applied to such cells. As with all gas-filled tubes, ionisation will take place at a certain critical voltage, in this case about 90. When this happens, the cell "motor-boats" violently, indicating that the voltage should be reduced.

However, when the system lost sensitivity, the voltage control could be advanced to compensate without causing ionisation, no matter how close it had been set to this point when the gear was first set up. Therefore, it seemed certain that the fault lay in the voltage supply to the P.E. cell.

## PROBABLE COMPONENTS

We took a quick look at the appropriate part of the circuit and found a handful of components which could cause the trouble. Some were resistors, and there were at least two capacitors. One of the latter was an electrolytic used to decouple the voltage divider from the main HT line. The other was a paper .1 mfd from the moving arm of the pot. to chassis.

A preliminary check with the ohm meter showed all resistor values to be correct and, although not conclusive, did suggest that these were probably OK. Likewise, a voltage check across the decoupling electro. showed no change in voltage over a reasonable time. Again this was not conclusive, but still valuable.

This left the .1 mfd decoupler on the moving arm of the pot. and which, if leaky, could easily wreck the voltage distribution. Mainly because it was easy to get at, I unsoldered it from the circuit and connected it across the resistance range of the VTVM. It immediately pushed the needle back to 50 megohms. This seemed rather significant, since it is not usually possible to measure the resistance of a good capacitor.

At the same time, this was not sufficient explanation in itself, since 50 megohms would not upset the circuit unduly. Also, where was the steady drift we had been seeking?

I picked up the soldering iron and held it under the suspect capacitor. After a minute or so I thought I detected a slight drop in resistance, and in another minute I was sure of it. I rigged the iron so that it would sit two or three inches below the capacitor without my aid, and we left it for a few minutes while we chatted.

## FALLING FAST

When I looked again, the needle was down to 20 megs., and falling fast. We checked it again at brief intervals, and it was still dropping merrily. Finally, at about the 1 meg. mark, it seemed to slow up a little, and I terminated the experiment. As far as I was concerned, the mystery was solved.

We fitted a new .1 mfd—one of the modern high temperature variety this time—and my friend went on his way a good deal happier about his equipment. Subsequent observation over a number of shows confirmed that the trouble had been cured.

The explanation, of course, is quite simple. There was enough heat present in the amplifier to cause a serious drop in resistance of the faulty capacitor, even though it probably took a lot longer than it had on the bench. Thus the voltage to the cell slowly dropped, and the sensitivity along with it.

I wish they were all as easy as that!

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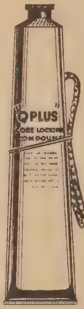

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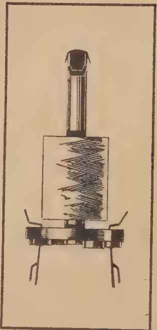

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An unshielded line linearity coil recommended for the adjustment of picture horizontal linearity by means of a variable inductor (linearity coil) in series with the damper diode anode and HT+, e.g. R.T. and H. 17in TV, May '57. Features "clip-in" mounting, base lug terminations and threaded iron core with hexagonal hole.

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# RESISTANCE/CAPACITY COUPLING

One of the circuits we seem to accept without question these days is the coupling between successive audio amplifier stages. Actually there is quite a deal to it and the full significance of component values is well worth understanding if you are to get the best from your amplifiers and receivers.

I 90 per cent. of cases, coupling be- ween stages is made with a resistance acitance network. An alternating tage is developed across the plate d resistor of a valve due to the alter- ing component of the valve's plate rent. This voltage is required at the d of the following valve.

The grid of the following valve can, d sometimes is, connected directly to plate of the driving stage but this kes it difficult to provide the correct d bias. To get over the problem a acitor is placed between the two cir- ts with the result that the alternating tage only is transferred.

The average grid voltage, or bias, of following valve must be controlled thout appreciably disturbing the alter- ting voltage and this is usually done connecting a high value resistor be- teen the grid and some other point hich determines the bias voltage

The value of each one of the com nents mentioned has a bearing on the eration of the amplifier

## ATE LOAD VALUE

Take the plate load resistor first The lue assigned to this resistor affects e gain of the stage, its frequency re- onse and the maximum output vo e it can deliver. Distortion is tied up th the plate load resistor value and the al choice may be a compromise be- een conflicting factors.

A very high value will give high gain it the high frequency response will be nited. This is due to the fact that ere is always a stray capacitance effec- ely in parallel with the resistor. It is ade up of the output capacitance of e driver valve, the input capacity of e following valve and stray capacity om coupling capacitor to ground.

As the frequency is raised, the nce of the capacitor becomes lower til finally it is equal in value to the sistance. At this frequency the ampli- ation will only be about 70 per cent the amplification at low frequencies

In ordinary audio frequency ampli- rs about the highest plate load resi nerally used is 0.25 megohm although here high gain is more important than tended frequency response. 0.5 or even 0 megohm may be used.

Lower values are needed when it is sired to extend the frequency re- onse, values such as 0.1 megohm or 047 megohm being used in audio fre- ency amplifiers. Video amplifiers may quire the load to be reduced to a few ousand ohms in order to keep the am- ification constant at the upper end of e range.

With low values of load resistor, both e gain and the maximum output volt- e are reduced.

Gain can be increased by using a valve with a high mutual conductance but there is a practical limit to this because of the difficulty in making a compact, economical and reliable valve. The result is that, very often, more stages are needed for a wide band amplifier

Maximum output can be increased by increasing the plate current of the valve but this involves a larger valve and a more expensive power supply.

In extreme cases, it is necessary to become involved in all sorts of complications with peaking circuits in order to get the required performance at reasonable cost but even then there are limits to what can be achieved.

The coupling capacitor has an important bearing on the performance of the amplifier. If it is large physically, it can have a significant capacitance to a metal chassis and prejudice the high frequency performance but, in general, it mainly affects the low frequency response.

In conjunction with the grid return resistor, this capacitor forms a divider network, in which only the voltage developed across the resistor is applied to the following valve. Therefore, if the reactance of the capacitor is high compared with the value of the resistor, the voltage at the grid is reduced

Large capacitors with adequate voltage rating are expensive and therefore the aim of the designer is always to make the grid return resistor of the following valve as large as possible in order that the capacitor value can be reduced

The upper limit for the resistor depends on the valve and its operating conditions. In many cases 0.5 megohm is the largest value that can safely be used but in special cases even up to 10 megohms is suitable.

## LF RESPONSE

While the plate load resistor and the previous valve do have some effect on the low frequency response, in most cases it is reasonably accurate to say that the low frequency response varies in proportion to the values of the capacitor and grid return resistor

This being true, the value of the capacitor can be reduced by a factor of 20 when the grid resistor is increased from 0.5 to 10 megohms for the same frequency response.

With ordinary audio amplifiers, values of the order of 0.05 uF and 0.1 uF are frequently used where the grid return resistors are about 0.5 megohm while 0.005 may be adequate to give equal performance when 5 and 10 megohm grid return resistors are permissible.

If you are keen on figures you can work out some examples for yourself. The amplification drops to 70 per cent. of that at mid frequencies approx. the frequency at which the reactance of the coupling capacitor equals the value of the grid return resistor

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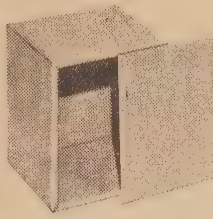

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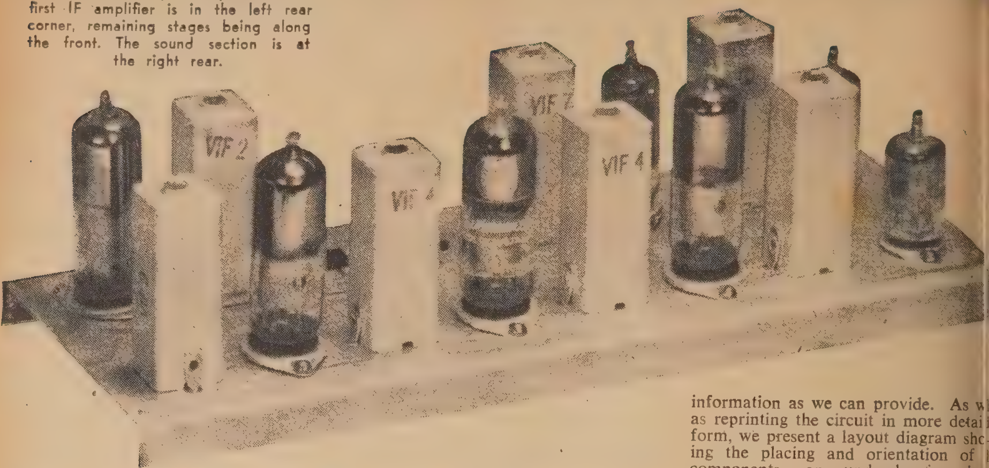
The complete IF strip, showing the layout of the major components. The first IF amplifier is in the left rear corner, remaining stages being along the front. The sound section is at the right rear.



# How To Build Your Own IF Strip for TV

Here is a detailed description of how to build a first class television IF strip around a set of commercial coils. For those who are keen to do this job themselves, but have hesitated due to lack of essential data, this article should provide the answer. Performance of the finished strip is extremely good.

### by Philip Watson

WHEN we launched our 17in T.V. receiver in the May issue, we based our description on the assumption that most beginners would be content to purchase a ready-made, pre-aligned IF strip. It seemed to be the most satisfactory solution — at least initially — to the problem of alignment, etc., and we doubted whether many enthusiasts would be in a position to tackle this job themselves.

As it has turned out, the reverse appears to be the case, at least as many constructors being prepared to do the job themselves rather than buy the ready-made variety.

## SEVERAL REASONS

There are several reasons for this. An obvious one is the purely financial aspect, since it is possible to save something like £7 by "rolling your own" —even assuming that you buy everything brand new — and this is a worthwhile economy for anyone's purse.

Another is the fact that at least one kit supplier is offering an alignment service for his own customers, thus overcoming a major problem for most enthusiasts.

And, finally, there is always the straight-out desire to make these things for ourselves, simply for the fun and experience of doing it. It's the kind of urge which makes the radio hobbyist "tick" any way and one which has received a terrific boost with the advent of T.V.

The only information published to date was the circuit which we included in the complete T.V. receiver circuit, plus an alignment pamphlet issued by the coil manufacturers. As a result, home builders still had to solve the problems of layout and wiring, and we received many requests that we publish such information.

Here, then, is the story of the construction of such a strip, with as much information as we can provide. As w as reprinting the circuit in more detai form, we present a layout diagram sho ing the placing and orientation of components, an underchassis pho graph, and step-by-step alignment structions and waveforms.

The strip is built around the " Plus" kit of coils and follows the c cuit and layout recommended by t makers. We make no apology for spe fying a particular brand in a case li this, since it would be very unwise substitute other coils, probably intend for quite different circuitry, for use w the present arrangement. Converse there would seem to be little point using any but the maker's circuit these coils are to be used.

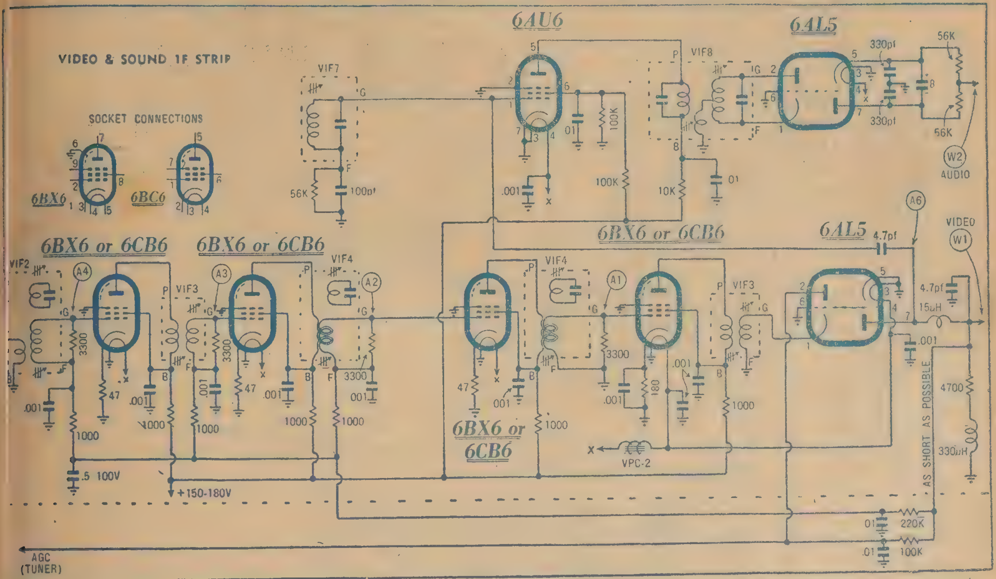
Also, we have deliberately avoid making any major changes in the la out. While it is always easy to su gest alternative arrangements, the poi is that the present layout works, a works particularly well. Since chang would only cause confusion without se ving any useful purpose there seem to be little point in making them.

## CIRCUIT DETAILS

As can be seen from the circuit, seve valves are used altogether. The vide amplifiers are either 6CB6s or 6BX6 while the sound IF amplifier-limiter is 6AU6. Two 6AL5s are used, one the sound ratio detector, the other as th video amplifier, AGC and tuner AG clamp. Apart from the sockets an socket connections there are no chang required for either the 6CB6s or th 6BX6s.

There are five video amplifier tran formers, being a type VIF2, two VIF and two VIF4s. The VIF2 has a sing tuned link winding, and a trap coil. Th VIF3s are double tuned overcouple bandpass types with adjustments in th primary and secondary windings in th usual way. The VIF4s are single tune bifilar windings with a trap circuit. Loac ing resistors are used across variou

# CIRCUIT IS SIMPLER THAN MANY RADIO DESIGNS



The circuit is no more complex than that of a conventional radio. Note the Alignment and Waveform numbers and that the adjustable iron cores are shown in the correct relative positions. Circuit is identical for either 6BX6's or 6CB6's.

ndings to control their bandwidth and ).”

These circuits combine, when correct- adjusted, to give an overall response rve which can be brought very close the theoretical ideal. We will have ore to say about the actual alignment ocess a little later on.

There are two sound IF windings, pes VIF7 and VIF8. The VIF7 is a gle grid winding used in the input cuit and the VIF8 is a conventional tio detector transformer. Both are ned to 5.5 Mcs. When these are cor- ctly adjusted they provide the normal nd-pass and discriminator “S” curve required for the FM sound system.

## ONSTRUCTION

Coming to the actual construction, ere are several approaches which may considered. You may buy a pack- ged kit—“complete to the last nut d bolt”; you may buy a ready-made assis and the major components separately and make use of whatever you ve in the way of resistors and capaci- rs; or you can make your own chas- s and buy whatever other parts you ed.

A completely packaged kit has much recommend it, since it saves much luable time trying to track down mponents which your dealer always ems to be “missing” just when you ost need them. The total cost is nerally about the same as the cost the individual components and may tually work out cheaper when you ke other factors into consideration.

On the other hand, those fellows who ave a goodly stock of minor compo- ents on hand will naturally feel inclined to purchase only larger items, such as coils and valves and, possibly, the chassis. A natural extension of this idea is to cut your own chassis, and there is no reason why anyone handy with tools should not do so. It is a simple chassis—little more than a plate really—and we will have blueprints available for those who require them.

However, there is an important point to watch in the above suggestion. The various by-pass capacitors used in the strip are rather critical and it would be very unwise to use odd paper types from the junk box, even assuming that they test 100 per cent. for both capacitance and leakage.

The fact is that even brand new conventional paper capacitors are not recommended for such applications, the inductance they possess making their by-pass capabilities extremely doubtful. The best choice appears to be the miniature ceramic types, with the metalised paper types a good second choice. In fact, the latter were used in our own strip, as well as many others we know of, and have worked quite satisfactorily.

## ASSEMBLY

Having obtained your parts, commence by assembling the valve sockets and coils, taking particular care to preserve correct orientation. Reference to the layout diagram will clarify this point. If you decide to use 6CB6's the changes required will not be great, the main point being to retain the approximate positions for the various grid and plate pins.

## PARTS LIST

1 chassis 10⅜in. x 4in. x ½in.
4 6BX6's or
4 6CB6's
1 6AU6
2 6AL5's
7 unshielded valve sockets. Suit above valves.

### COILS

1 VIF2
2 VIF3's
2 VIF4's
1 VIF7
1 VIF8
1 VPC-2
1 VPC-15
1 VPC-330

### RESISTORS

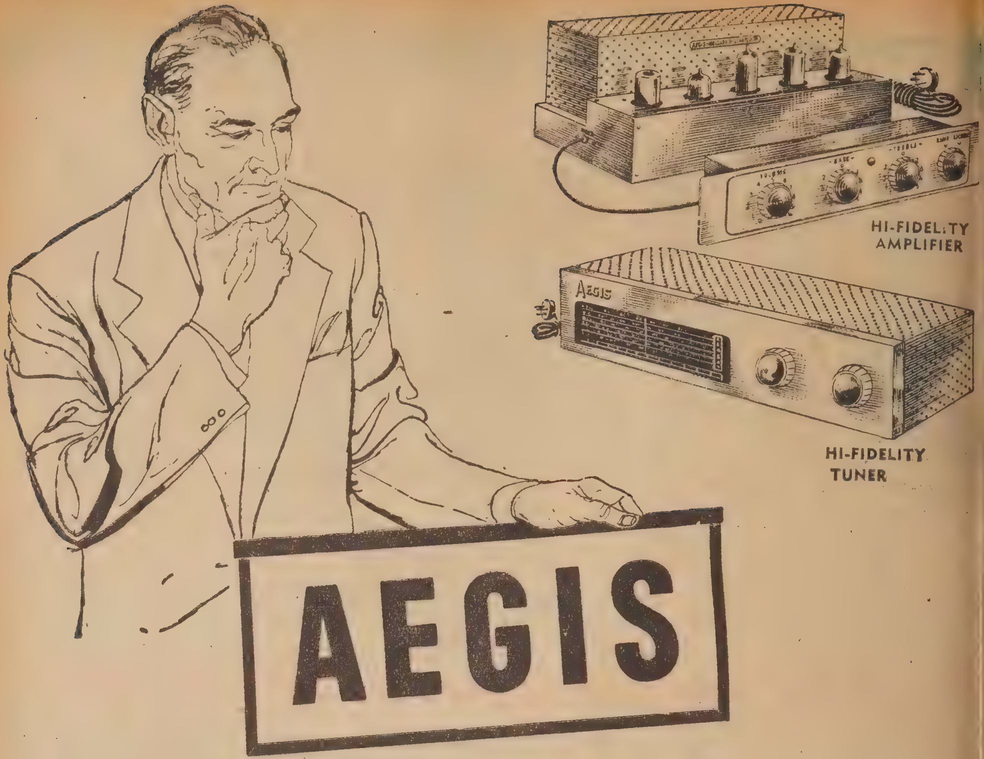
All ½ W type
2 .1 meg.
3 .056 meg.
7 1000 ohm
1 180 ohm
3 47 ohm
1 .01 meg.
1 4700 ohm
4 3300 ohm
External to strip
1 .22 meg.
1 .1 meg.

### CAPACITORS

1 8 mfd 100v electrolytic
1 .5 mfd 100v paper
All following ceramic or metalised paper types
2 .01 mfd 400v
11 .001 mfd 400v
2 330 pf
1 100 pf
2 4.7 pf
External to strip
2 .01 mfd 200v

### MISCELLANEOUS

1 5 tag terminal strip
3 3 tag terminal strip
2 2 tag terminal strip
18g tinned copper wire, hook-up wire, co-axial cable, nuts and bolts, solder lugs, etc.



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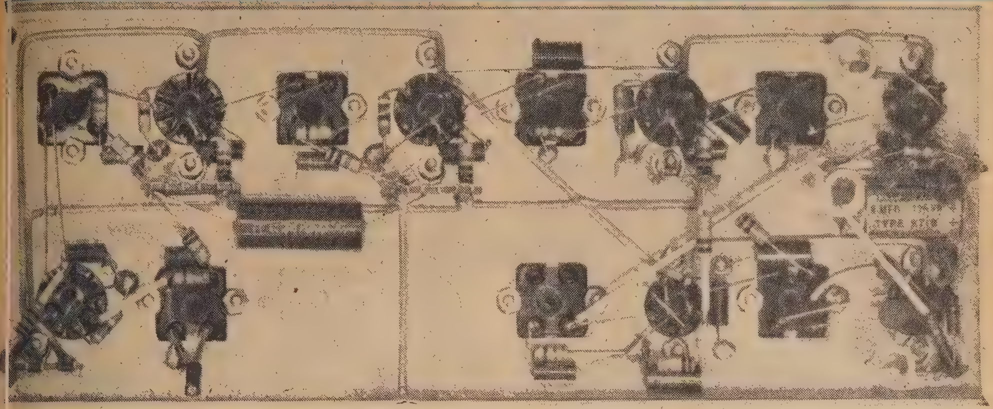
# UNDERCHASSIS PHOTOGRAPH AND LAYOUT DIAGRAM



he underside of the strip, showing most of the wiring. Compare this with the layout diagram below. The first IF transformer (VIF2) is at lower left, with the remainder of the run along the top. Sound section is at lower right.

Watch particularly that the seven tag terminal strip mounted near the video detector does not project beyond the edge of the chassis, otherwise it will foul the main chassis when the strip is mounted. Some ready punched chassis have this hole somewhat out of place and it may be necessary to drill a new one or, if the error is slight, give the supporting tag a slight twist between the foot and the insulating strip.

Note that some of the AGC components are mounted outside the strip on the main chassis, but are shown in this circuit for the sake of completeness. Also, the lead from the video detector to this external tag strip should be kept as short as possible. The external components are shown outside the dotted border surrounding the strip diagram.

## WIRING

Having completed the assembly we can think about the wiring, and this is as good a time as any to say a few words about, and make a plea for, neatness and all round good workmanship. We are prompted to do so by one or two recent examples—involving our TV Receiver—and which were certainly not calculated to inspire confidence in the performance of the finished job.

There may be those who argue that beauty is only skin deep and that it is the accuracy of the connections which is all that matters, but there is more to it than that. Quite apart from the personal satisfaction of a job well done there are several practical advantages to making a neat job.

For one thing, long straggling leads and component pigtails which have not been trimmed or straightened, generally mean that some vital leads are longer than they should be and the result is a foregone conclusion.

Secondly, there is no doubt that a neat and logically laid out chassis is ever so much easier to check and service than an untidy conglomeration of parts which look as though they have been thrown into place.

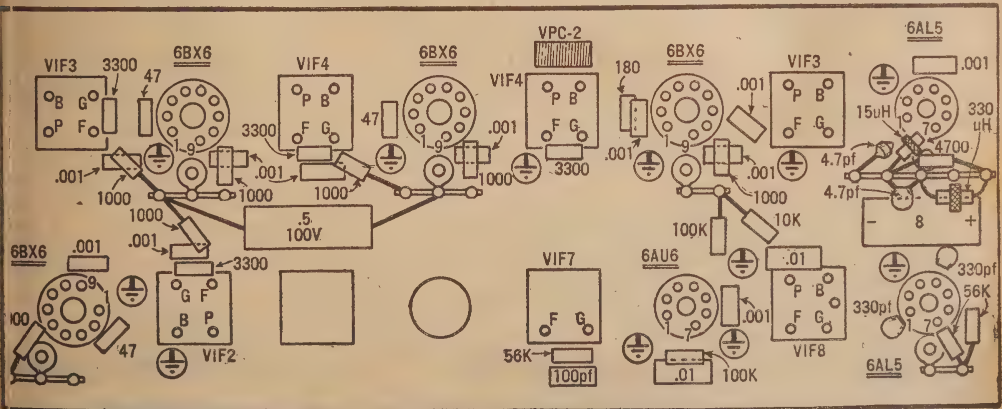
Even more important is the fact that you will probably have to submit your efforts to a professional organisation for final test and alignment. These people reserve the right—quite understandably—to reject any unit which does not look as though it has a reasonable chance of working.

## KNOCK IT BACK

Even if they do accept a job which is bordering on the "rats' nest" variety, they are unlikely to spend any time on it if it does give trouble — regardless of whether the trouble is due to wiring, components, or anything else. They will probably advise that the unit be taken home and rewired properly.

The layout shown in the diagram and photograph is such that all important leads are short and clear of other leads, and all earth returns are made to logical points. If you follow it with reasonable care you should have no need to apologise for the final result.

In actual fact, the unit does not appear to be particularly critical, and we have seen versions in which considerably more wiring liberties were taken than in our version, and which appar-



This layout diagram shows the placement and orientation of all components. Note also the earth points which are logical and convenient. Reference to this and the photograph above should solve most layout problems.

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| Battery Chargers, 6 or 12 volts, 3 amp. | 99/6 ea. |
| 230 volt A.C./110 volt D.C. 100-watt inverter | 19 Gns. |
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| Recessed Knobs, in various colours, | 3/ doz. |
| 16-drawer Cabinets, slightly shop soiled | 35/ ea. |
| Good quality speaker silk normally 17/6 yd | Now 15/6 yd |
| Electrolytic Adaptors | 1/ doz. |
| OSL/50 Dials | 35/ ea. |
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| 12in Bass Speaker, well-known brand, | £10/10/ |
| Disappearing Top Cowl Aerials, | £6 |

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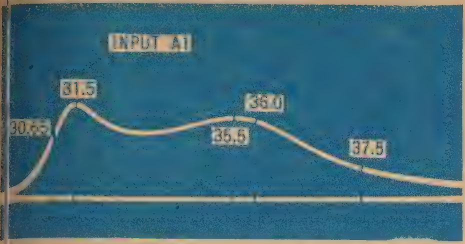


Figure 1. Adjust last VIF3 for double hump.

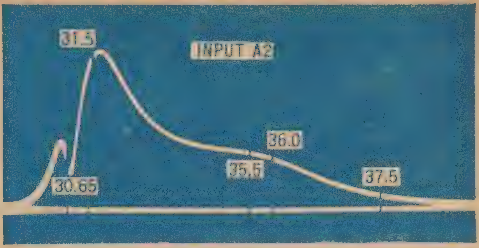
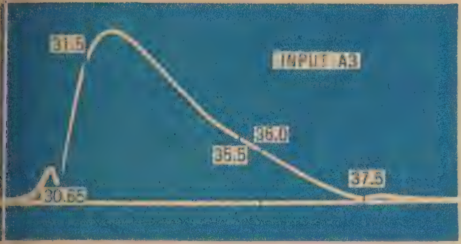


Figure 2. Set 2nd VIF4 trap to 30.65 Mcs., bifilar to approximately 31.5 Mcs.



igure 3. Set 1st VIF4 trap to 37.5 Mcs., bifilar to give above waveform.

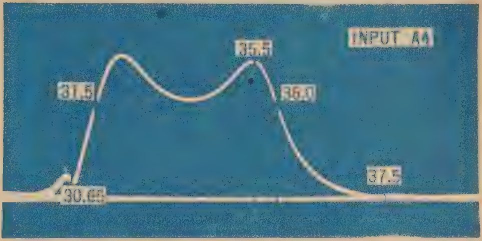


Figure 4. Adjust 1st VIF3 to double hump response as shown. Check marker points carefully.

ely worked quite satisfactorily. At t same time there does not seem to be ay point in taking unnecessary risks.

Most of the short wiring is done with lg. tinned copper wire which has been saightened first by stretching gently. ring is point to point, without any fcy bends, particularly on grid and p.te leads. Insulating sleeving is not ressary in most cases, but one or two lds run close enough to justify insu lion These can be seen in the pho tgraph.

These connections, plus those using t pigtails of resistors and capacitors, vl complete the greater part of the ving. The remainder, mainly filament, F. and AGC, may be run in conventnal plastic hook-up wire. Note that t filament circuit uses only a single le, the remaining pin being earthed a each socket.

## FILAMENT BY-PASSES

One point about the circuit which may apear puzzling at first concerns the b-passing of the filament line. As shown, tre are two by-passes which appear t connect to the same part of the filarnt line. One is from the 6AL5 video ctector and the other from the 6BX6 c 6CB6 immediately preceding it. Although we did not find it necessary the takers recommend that these two points c the filament line be by-passed right a the respective sockets. The original ccuit accompanying the coils may not aree with ours, and is apparently incrrect.

If you use a steel chassis we strongly rcommend that the various earth points idicated be made by soldering direct t the chassis. This will call for a larger in than the usual variety, say 100 watts c more, or one of the low voltage quick lating variety, but it would seem to l worthwhile to try to borrow someting suitable if it is not already available.

Fairly early in the piece — not later than the completion of the assembly — these earth points should be established in preparation for the wiring. Using the layout diagram as a guide, deposit a small blob of solder at each point indicated. The commercial "passivated" finish takes solder quite readily and no preliminary cleaning or special fluxes will be necessary.

## LOGICAL POSITIONS

Once these points are established it becomes fairly easy to connect the various component pigtails to them, though a heavy duty iron will still be necessary. While on this same subject we should point out that the position of the earth points does not appear to be particularly critical. We have selected them as being the most logical arrangement, in both the physical and electrical sense, but we have seen less logical arrangements which apparently worked just as well.

In fact, we have had the opportunity of checking with one organisation who have wired a large number of these strips, as well as a number of individuals who have made their own, and we have had no reports of instability or anything approaching it. (We are discounting a couple of cases where faulty screen by-passes were encountered.) In short, the design appears to be an inherently stable one.

In the event that an aluminium chassis is employed it would be quite satisfactory to provide the usual earth lugs under existing or specially located mounting bolts.

In mounting the actual components there are a few points worth noting. Some brands of resistors at present available, while perfectly satisfactory in all other respects, are not self-insulated as are some other types. As a result, shorts may occur if they are allowed to rest against the chassis or adjacent bare wiring. Provided this point is appreciated, it is not a serious disadvantage in this type of resistor.

## CAPACITOR PROBLEMS

Similarly, the small metallised paper capacitors may present problems to those who have not handled them before. Particularly where very short leads are required, it is sometimes difficult to effect a good soldered joint and, at the same time, avoid damaging the outer case of the component with the heat involved.

Most of the trouble is due to heat being conducted through the pigtail to the body of the component and is best controlled by gripping the pigtail between

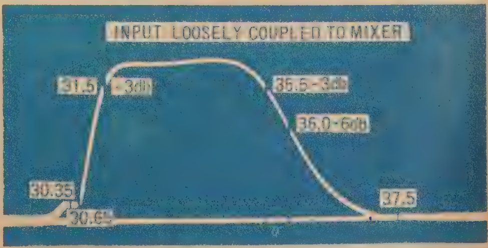


Figure 5. Here is the final response curve, the VIF2 and coupling coil in the tuner, being adjusted to fill in the trough between the humps. The trap is set to 30.35 to complete the sound plateau Note that this picture was taken before those reproduced above.

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ws of your long-nosed pliers. Al- ou not always appreciated, the same ocedure is desirable for resistors. hi can change their value if sub ct to too much heat.

Art from the foregoing points it oy necessary to exercise reasonable re and the normal standards of good ir practice in order to duplicate rig al version.

When the wiring is completed it ould be visually checked as thoroughly ssible and, if convenient, it may ven a rough voltage check. This nts of feeding the unit with appro- ia heater and HT voltage and check- g hat all heaters function and that ltage is present on all plate and re pins.

Though a relatively elementary check, y reveal one of those "silly" mis- ke which can waste a lot of time ne the alignment procedure is com- ered—an important item if you're g for someone else's time

## LIGNMENT

the unit appears to pass this ex- ation satisfactorily we are ready he actual alignment process. It od be appreciated right from the at that it is virtually impossible to g a strip of this nature without the of a sweep generator, CRO, and sciated equipment. Therefore, if you ot possess such equipment, pass it e to someone who does and do not empted to fiddle with the adjust- ers yourself or align it with an or- ny generator. While you may not ny harm, you won't do any good th; but merely waste a lot of time

However, for the benefit of those who av access to such equipment we will t the steps necessary for this par- cur strip. It is assumed that the e is familiar with the operation of ep generators in general and reason- l conversant with his own equipment. ewill concentrate on points peculiar is strip.

T facilitate rapid and positive iden- iction of the various test points, we av labelled the circuit with "A" lnment) numbers where the genera- rs to be fed in and "W" (Waveform) ers where the CRO is to be con- ed. We have also shown the coil or in their correct relative positions. all primaries or bifilar windings as tom cores, and all secondaries or a as top cores.

e have also reproduced a series of ographs, taken directly from the rn of the C.R.O., of the wave forms tned from the various test points in r own strip. Note particularly the l result, which is extremely good, probably unlikely to be bettered where. As far as we can see, there o reason why the home builder ld not approach this very closely

## VEFORM GUIDES

the same time, we would empha- that the waveforms displayed should egarded as a guide only. Due to etable variations in layout, valve acteristics, and even the coils them- s, there is no guarantee that the overall response will automatically lt from achieving each individual eform, or even that these waveforms be exactly duplicated.

all cases the final waveform is the criterion assuming that it is

achieved without seriously prejudicing the overall gain. If, therefore, having followed the sequence we are about to describe, the final result is not optimum, a little intelligent "fiddling" with the various cores is quite permissible. In fact, it is quite surprising the degree of improvement obtainable by moving a couple of cores half a turn or so.

It must also be appreciated that the strip cannot be considered as a completely separate item, the response curve being affected to an appreciable extent by the characteristics of the tuner to which it is connected. Ideally, therefore, the final alignment should be made only when the strip and tuner are mounted in the main chassis and permanently coupled together.

## CALIBRATING THE CRO

During the actual alignment process it is necessary to refer constantly to various check points on the response curve, it being customary to set the marker generator to each point in turn as required. This can be a tedious and time-consuming process, as it may be necessary to check as many as five points on each response curve before passing on to the next one.

It is also extremely easy to be misled by the general shape of the curve, resulting in a curve which looks right but which fails to measure up to specifications when the marker points are set up. This may mean scrapping a complete set of adjustments for the whole strip and going back to "scratch."

In the absence of a multiple marker generator (as used industrially), the next best approach appears to be that of calibrating the face of the C.R.O. It is generally possible to make a useful mark on the glass face with a pencil, though some types of crayon may be better. Provided care is taken not to touch the relevant controls afterwards, these can be used throughout the alignment process.

Mainly to preserve the marks in our photographs, we resorted to another trick. Using some stretched 26g tinned copper wire, we fastened a series of vertical rods to the front of the C.R.O. face, holding them in place with sticky tape. They appear in the photographs as small breaks in the trace and are easily identified.

## MARKER FREQUENCIES

The major marker points are as follows: 37.5 Mcs, the adjacent channel sound frequency; 36 Mcs, the picture carrier frequency and which should be 6db from the top of the response curve (approximately half-way down the slope in practice); 35.5 Mcs, the "3db down" point just after the roll off from the top; 31.5 Mcs, in this case the 3db down point at the other end of the response; 30.65 Mcs, the first trap for the sound plateau; and 30.35, the second trap for the sound plateau. Check these points on the accompanying photographs.

We would once again emphasise that the correct shape of the curve can only be judged by constant reference to the appropriate markers. Non-linearity in the sweep circuit, an unduly compressed or expanded image, and other factors, can all combine to produce an image which looks good even though it is bad, or one which looks bad even though it is correct.

Another pitfall is overload. This causes the top of the response curve to flatten off in a manner which may lead the uninitiated to imagine that he has produced a perfect curve! It is a good idea to establish just where this occurs by advancing the gain and restricting the pattern height of the CRO. A point will be found where the top of the response seems to strike an invisible barrier, flattens off, and will go no further. This is the condition to avoid.

Allied to this is the question of bias. For various reasons it is not possible to make full use of the AGC bias during alignment, and this must be provided artificially. A 4.5-volt torch battery connected between the AGC line (negative) and the chassis is the most effective way of doing this.

After all these preliminaries have been taken care of, the actual alignment can be commenced. The CRO is connected to the video output (WI) using a .047 meg resistor in series to minimise RF in the CRO lead and possible regeneration.

## FIRST STEP

The sweep generator is fed into point A1 and the primary of the last IF adjusted to produce a peak at 31.5 Mcs. The secondary should now be set to 35.5, producing the double hump response shown in Figure 1. If it should transpire that it is difficult to place these two humps far enough apart—as it was in our case—it will be necessary to provide some additional coupling between primary and secondary.

This is done by connecting a small amount of capacitance between the grid and plate pins of the coil, a short length of twin plastic lighting flex being a very convenient way of providing it. Start with about an inch of flex and separate just enough to reach the two coil pins, leaving the remainder standing upright.

This will probably be a trifle too much "C," pushing the humps too far apart. If so, clip about 1/16in from the flex and try again, repeating the procedure until the desired result is obtained.

**Be most careful to see that all cores peak in their outermost positions. If peaked on the inner position, the close physical relationship between them will cause spurious and unwanted coupling between the windings.**

Now to input point A2, reducing the generator gain if necessary. First set the trap circuit to 30.65 Mcs. Trap circuits produce a marked dip in the response which can be "walked" across the response curve to the desired point. Setting this one correctly is the first step in producing the sound plateau.

## SECOND STEP

Now tune the bifilar winding to 35.5 Mcs., producing the lopsided response as in figure 2. Check that this does not upset the trap circuit, and readjust if necessary.

With the sweep connected to input point A3, there is another trap to be set, this time at 37.5 Mcs. It is not easy to set the bifilar winding to a specific frequency, it being more useful in effecting minor changes in the general shape of response (see figure 3). However, it can be used to control the height of the sound peak and, ultimately, the plateau.

This value is fairly important, and is recommended as 5 per cent. of the maximum height of the curve. If it is appreciably less than this it is possible that the sound level may be inadequate; while, if greater, it can cause frame buzz in the sound.

This is due to the basic fact that, when two signals are mixed in a non-linear device, the resultant beat (the 5.5 Mcs. sound IF in this case) will favour the modulation contained in the weaker of the two. In this case we require the frequency modulation of the sound-carrier, so we keep its level weak relative to the picture-carrier.

The input point A4 brings us to another double-tuned IF. Once again we require a double hump effect, though this time it must be deliberately unbalanced to favour the 35.5 Mcs. region. However, it is still important that the humps be adequately spaced and it will probably be necessary to overcouple it in the same manner as the other VIF3. The result should be as in figure 4.

## TUNER ADJUSTMENTS

At this stage we need to have the tuner in operation and, ideally, both tuner and IF strip mounted in the main chassis. Test point A5 is a very loose coupling to the mixer valve—in our case a scrap of sheet copper bent to form a shield which was a neat fit over the glass envelope. The regular shield is removed, the new one fitted—taking care not to earth it—and the generator lead clipped to it.

The last trap (VIF2) should now be adjusted to 30.35 Mcs., though a little juggling is permissible to produce a reasonably flat plateau. The height of the plateau should also be checked at this point and, if it appears incorrect, it may be necessary to go back to the A2 or A3 inputs and modify the height of this peak accordingly. Since this will modify the remainder of the response curve, the remaining steps should be checked again and corrected as required.

Assuming the plateau is correct, the tuned winding of the VIF2 coil and the coupling coil in the tuner should now be adjusted. This combination normally produces a single hump response which is very useful to "fill in" the dip in the middle of the response as evident in figure 4.

If the "Q" of these circuits is too low there will be insufficient amplitude to achieve this, while if too high, it will tend to round the top of the response. In the case of the R.T. & H. tuners it will usually be necessary to load the tuner coupling coil with about 2,200 ohms, but this can easily be modified if necessary.

The final result should be as in figure 5, or very close to it. The fact that we have been able to achieve this curve on two consecutive strips (July, page 79) suggests that others should behave similarly. It is therefore well worth striving for.

## THE SOUND SECTION

Adjustment of the sound section can be accomplished in several ways. It may be done with the sweep generator and CRO, using 5.5 Mcs. crystal to set the centre of the "S" curve accurately or, using the same signal source, a DC voltmeter may be substituted for the CRO. Thirdly, a station signal can be used in conjunction with the DC voltmeter. This latter arrangement has the advantage of greatest accuracy.

If using your own signal source, this should be fed in at point A6 to avoid loading the VIF7 winding. The waveform or DC voltage is taken from p W2.

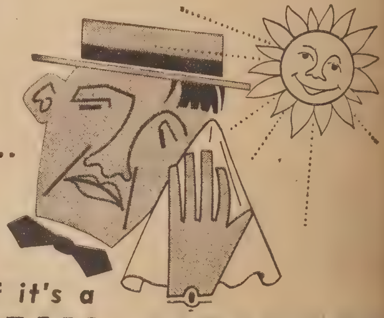
When using a voltmeter, the proced is deliberately to unbalance the second of VIF8 (it probably will be unbalanc anyway), thus giving a meter reading dicative of the adjustment of the ot windings. These—VIF7 and the prim of VIF8—are adjusted for maxim output.

The secondary of VIF8 is then adjus for zero output, the zero of the m being checked to ensure accurate adju ment. In most cases this will result settings which tally very closely w those obtained on the CRO.

## SEALING THE CORES

Finally, having achieved correct justment of the cores, there comes question of sealing them to prev mechanical drift. There are ma schemes and a number have been cussed in recent Argument articl Most fail in one respect or another, a we would like to see a better approa to the problem by coil manufacturers

In the meantime, we have a perso preference for the use of a strip of ru- ber between the core and the former. section of thin rubber-band—the thin the better—is simply fed into the form and the core screwed in after it. It w make the core tight, but still capable smooth adjustment. This idea is us extensively in commercial sets, and only apparent disadvantage is that t rubber will ultimately perish, probab locking the core too securely.



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# Here's your answer, Tom!

We feel that Tom is going to be very versatile when he grows up judging from the variety of questions submitted. Television seems to be foremost in every one's thinking today and appropriately Tom's initial queries are based on this subject.

**Is it illegal to use an autodyne converter as a T V turret tuner? If so, could one use an R.F. amplifier ahead to prevent any radiated signals?**

It is not so much a question of legali-
t Tom, as (a) what is considered to be
od practice and, (b) a consideration of
e's neighbours. This last, for ex-
iple, is the main reason why we have
couraged the use of superregenerative
cuits in the past. They also have
diation problems. An autodyne tuner
probably quite practical in a T.V
ret tuner but we would suggest an
F. stage, to give the neighbours a
ir go" and also to improve the per-
rmance of the tuner as a whole.

★ ★ ★

**Would it be possible to use a neon tube oscillator as a line oscillator (or frame oscillator) and, if so, could it be synchronised by a coil of wire around the tube connected to the synchronisation circuit?**

We cannot speak from practical ex-
rience; Tom, but neon oscillators have
ver been noted for their stability, nor
r their ease of synchronisation. Con-
quently we feel that, by the time you
ve overcome these difficulties, you will
ve at least as many components as in
standard valve circuit, with probably
orer performance.

★ ★ ★

**Could you please tell me how to interpret valve code letters and numbers?**

The American system of valve coding
s become "saturated" with the variety
valves, but it was based on the fol-
wing idea: The first figure in the code
dicates the heater voltage, with slight
fferences, so that 1 stands for 1.5 and
volts, 2 stands for 2.5 volts, 6 or 7
r 6.3 volts, and so on.

The second figure denotes the number
electrodes in the valve, the metal shell
metallising being counted as one elec-
ode and the heater as another.

Intervening letters differentiate be-
veen different types of valves. Since all
e letters of the alphabet have been
sed, some valve codes use two inter-
ning letters.

Final letters, on some valve types, are
sed to indicate other types of envelope
r other special features. For example,
G" denotes a standard glass envelope
nd "G.T." denotes a small tubular en-
elope.

Early Continental valve manufacturers
nded to use their own system of cod-
g so that, at one stage, there were as many separate codes as there were manufacturers. Some moves were made to standardise the code and most of the valves that have reached the Australian market conform to this standardised European code.

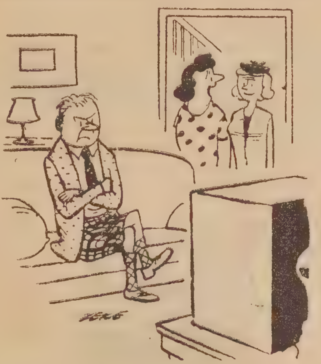
This system is too lengthy to detail on this page and one of these days we may devote a short article to it.

But really, Tom, system or no system, there is no substitute for valve charts or valve books which list the things you really want to know about a valve.

★ ★ ★

**What does an Ampere-hour mean and how is it connected with batteries?**

An Ampere-hour is a practical measure of quantity of electricity and is the amount of electricity delivered when a current of one ampere flows for one hour. Other combinations of current and time may also give the same product, such as 2 amps. flowing for half an hour, etc.



"Sandy never bothered to watch TV until we got caught for a licence!"

Accumulator cells are commonly rated by their Ampere-hour capacity, which is a number giving the current which can be supplied by the cell for a certain time. The Ampere-hour capacity is obtained by multiplying the discharge current in amps by the duration of current flow in hours and, at the end of the time specified by the Ampere-hour capacity, the cell may be considered to be discharged.

In some cases, cells may also carry a maximum discharge rating, which sets a limit to the load current which can be imposed on the cell.

The same general factors operate when re-charging a cell, namely, the maximum permissible charge rate and the total number of ampere-hours making up the charge.

Since no battery is 100 p.c. efficient, more ampere-hours are expended in charging the cell than it is capable of delivering, but, basically, it may be considered that a 50 ampere-hour cell may be recharged by passing 5 amps through it for 10 hours, and so on.

In the case of dry cells, any ampere-hour rating is rather ambiguous because the quantity of electrical energy varies a good deal with the order of the load current imposed on it. Rather than rate their dry cells in terms of ampere-hours, manufacturers are more happy to suggest the life in hours of their cells for different orders of load current and different periods of operation.

★ ★ ★

**How do crystal pickups, microphones and loudspeakers function?**

These devices, Tom, depend for their action on the piezo-electric effect of certain crystalline substances. Rochelle salt exhibits this effect to a greater degree than any other crystal, and is the most widely used.

When a suitably cut slice of Rochelle salt is placed between two conducting plates, it will expand or contract when potentials are applied between the plates. Conversely, when subjected to mechanical stress the crystal can be made to produce a voltage.

If slices of such crystal are cemented together, the assembly being known as a "bimorph," the combination will twist or bend markedly when potentials are applied between the plates. Conversely, significant potentials will be generated if the bimorph is subjected to mechanical stress.

In the simplest crystal microphone, a diaphragm transmits these stresses to the bimorph. In a better quality microphone a combination of two bimorphs is used to make a cell. Multi-cell combinations, to form a single unit, are also used.

The crystal pickup operates on a similar principle, the stylus being so attached as to cause mechanical stresses to the crystal plates, in sympathy with the groove variations.

A crystal loudspeaker operates in the reverse manner to the microphone.

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In like manner, enthusiasts the world over are expressing their approval of the QUAD II Amplifier—whereas we don't go so far to say the QUAD II is perfect, we do claim that it is the best which present techniques can devise. The Design of the QUAD II is simple and straightforward, without the sacrifice of a single refinement capable of contributing to the final objective.

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- ★ 1 outlet socket for taking off a signal suitable for recording, permanently in circuit.
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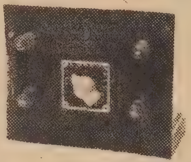

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ot welding is a form of resistance ng and consists of passing a suitable nt between two metals at the points joined. If the current is sufficiently the heat generated by the current, ng through at the point of contact, the metals together.

e method generally consists of pressing he metals to be joined between two ed electrodes. The current is then hed on for a sufficient period to ace the welding temperature.

c welding utilises the fact that if two rodes between which a current is ng, are slowly separated, an arc may between them through which the nt continues to flow. The voltage ss the arc increases with the arc h, being about 25 volts per inch in ase of copper electrodes. The number of amperes per unit cross-section of rc generally varies between 600 and 00 amperes per square inch.

welding, one connection is taken to work and the other to a movable rode. The arc is drawn between two members and the operator can t the intense heat of the arc to any of the work by moving the electrode.

he principle of the arc is not limited elding alone. Smelting furnaces also his principle and arcs drawn between carbon electrodes are used as ces of illumination for projectors in tres.

★ ★ ★

**How does a photo-electric cell nction?**

ertain metals exhibit the property of ron emission when exposed to light. group of metals, the alkali metals, a strong photo-electric effect with corresponding to the visible part of spectrum. Caesium is one of the efficient photo-electric emitters and idely used.

riefly, the emission photocell consists wo electrodes, the cathode and the de, within an evacuated or gas-filled lope. The cathode is either flat or ed to catch the maximum amount of .. and is coated with a thin film of or other of the alkali metals. The de faces the cathode and usually s the form of a wire loop or similar, s to obstruct as little as possible the directed on to the cathode. The de is made positive with respect to cathode so as to attract and collect electrons emitted by the cathode.

he current output of an emission- photocell is only a few microam- es and considerable amplification is ired before any practical use can be le of it. The uses of a photocell are erous, the best-known example being ound film projectors.

other applications, variations in the tocell current, after suitable amplifi- on, are used to trigger relays, etc. is the principle behind electronic nters, intruder alarms and such like.

★ ★ ★

**What is a leaky grid detector?**

leaky grid detector is a detector cir- that combines the functions of a ventional diode detector and of a tri- amplifier. All this may be accom- hed within a single triode valve.

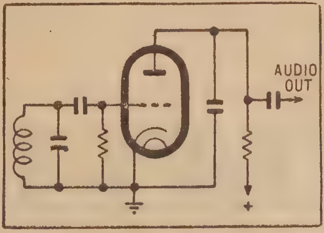
circuit of the basic unit is repro- ed and, refering to this, the action s follows: In the absence of any signal the grid assumes a potential such that a very small grid current flows. An incoming signal will now cause the grid to become alternately negative and positive. When a positive signal is applied, the grid will momentarily become positive and grid current will flow. In other words, electron flow will take place between cathode and grid.

Under these conditions rectification will take place in the same manner as in the conventional diode, the grid acting as the diode anode.

The function of the grid resistor is to leak away the accumulation of electrons at the grid which would otherwise make the grid permanently negative, due to the positive half cycles, to the point of blocking.

The value of the resistor is chosen so that the electrons may leak away from the grid at a rate commensurate with the slow changes of the audio frequency envelope, but not fast enough to follow the rapid radio frequency changes.

Putting it another way, we could say that the grid circuit of the leaky grid detector is so arranged that the grid will be driven negative in a manner more or less equal to the amplitude variations of the incoming signal. Since these grid voltage variations will cause corresponding variations in the anode current, the triode is also able to function as a voltage amplifier.



Basic circuit of a leaky grid detector discussed here.

The valve will also tend to amplify the radio frequency signal, which we do not require and, to overcome this, a bypass capacitor is connected from plate to cathode. The value chosen is such that it does not affect the higher audio frequencies but acts as a low-impedance bypass to the radio frequencies.

★ ★ ★

**What are alkaline cells?**

Alkaline cells differ quite radically in construction from the lead-acid type. The electrolyte is a solution of caustic potash or potassium hydroxide in distilled water. The specific gravity of this electrolyte is about 1.19.

Two types of alkaline cells are in use, the nickel-iron cell and the nickel-cadmium cell. In the nickel-iron cell the positive plates contain a nickel hydrate mixture which also contains graphite and other materials, while the negative plates consist of iron oxides.

In the nickel-cadmium cell the positive plates are of a similar material while the negative plates contain a mixture of cadmium and iron oxides.

The chemical action of an alkaline cell is very complicated but broadly, it may be described as the oxidation of the positive plates during charge and the reversal of this process in discharge.

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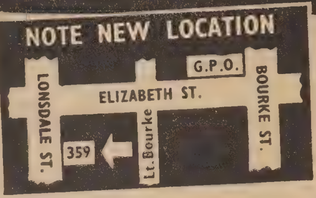

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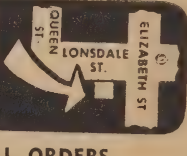

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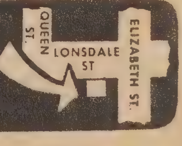

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# OUR 17-inch TELEVISION SE

## CONCLUSION

Although, last month, we presented the final major article on the R.T.& H. 17-inch TV Receiver we can usefully add a few remarks about circuit elaborations and answer a variety of questions which have been put to us by intending constructors. Elsewhere in the issue, we present a complete article covering the construction and alignment of a suitable IF strip.

OVER twelve months ago, you may recall, we asked the question, "Can a TV set be built in the home?" In the May issue, last, we answered our own question in the affirmative by presenting a complete design for home construction.

Reader response to the project has been nothing short of amazing and, in the intervening weeks, literally hundreds of chassis, transformers and other key components have been sold, indicating as many receivers under construction.

### QUICK OFF THE MARK

Even before the second instalment appeared, we had reports from readers who had raced ahead and completed a receiver, working only from the original circuit and photographs. Since then, the number has been growing steadily and the pleasing aspect is that no one seems to have had any special trouble in obtaining excellent pictures and sound. This has been gratifying indeed.

To be sure, the successful constructors have not been novices at the game but experienced home-builders, amateurs, factory technicians and others, who have tackled the project both to save money and to gain experience in the new field.

This is only what we expected and, in fact, home TV construction activities will probably remain centred in this group. Notwithstanding our best efforts with diagrams and photographs, we would hesitate a long time before encourag- ng a novice to attempt anything quite so ambitious as a et.

It was our intention, earlier, to follow up the orig /-inch circuit with a modified version containing various ible elaborations. However, having lived with the proto eceiver for several months and viewed copies of it, we h vised our ideas considerably

In short, success of the original design has been so ualified that it is hard to justify the inclusion of such elab ions. To release a new, complete circuit containing th would carry the inference — quite unjustly — that the ear one was in some way inadequate or out of date. Noth ould be further from the truth

### ONE STANDARD CIRCUIT

Another important point is that trade supply houses h organised things around the original design and, to introd another 17-inch circuit at this stage would only lead to necessary confusion and to arguments as to who wants w —and for how much.

We have therefore elected to treat any elaborations entirely optional, to be adopted or ignored according to sonal preference. Any components involved can be arran for, over and above the one basic kit.

This being so, we have reprinted the full schematic cuit overleaf, essentially in its original form. Apart fr anything else, it will provide a second copy for those wh original circuit may by this time have become defaced.

In reprinting the circuit, we have taken the opportu of correcting one or two errors and adding other items of formation, most of which have been listed in previous issu

We have modified the drawing slightly to emphasise subdivision of the major circuits and added voltage rati to several capacitors, in line with components which are n available. The IF circuit has been redrawn also, to make conform in appearance with the circuit elsewhere in the iss

These are all relatively minor points but they will ens that you have a circuit available which is as up to date as can possibly make it.

So much for that. It now remains to comment as nec sary on various portions of the circuit, mentioning any re vant points or possible modifications.

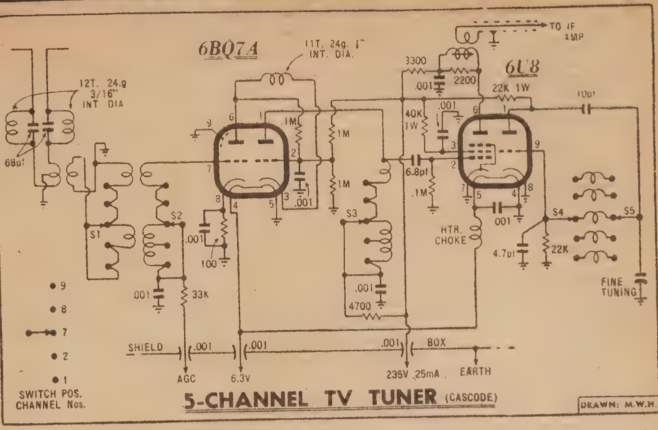
Firstly, the pentode tuner, which was originally descri in the February, 1957, issue.

### WORKS WELL

This unit is still in use with the prototype receiver and proving quite satisfactory in practice. It provides plenty signal on all channels in a good average location, has giv no trouble due to switch contacts and has proved complet free from frequency drift.

It remains a proposition, therefore, for anyone who c expend the time to build it more readily than the money buy a commercial unit.

# CIRCUIT OF "CASCODE" TV TUNER



Here is the essential circuit information for readers who may want to experiment with a home-constructed cascode tuner. The 33 Mc aerial filter may be useful in areas where medical and industrial heating equipment causes interference on the low channels.

r those who may have missed out on he February issue, a few copies still re ain in stock at the time of writing. W le the original article gives the essential information necessary to duplicate th uner, a few additional remarks may be helpful, covering construction and ac stment.

irstly, you will note that we now sh a small IF trap connected in series w the feeder input circuit.

his filter will not be necessary in o nary suburban locations but may be o value in certain areas, where medical a industrial RF heating equipment is in se. Some of this equipment radiates a lamaging amount of signal around 3 Ic, which may penetrate to the rec er IF system, particularly when the fr t-end circuits are tuned to one of th lower frequency channels.

## FILTER

n such a case the inclusion of a filter c tred on the IF band may help matters, t ugh it obviously cannot obviate interference from such sources, due to har nic radiation on higher frequencies.

The accompanying sketch gives all e ential details of the trap. It can best assembled on a scrap of resistor panel, h the eyelets removed carefully and r inserted as shown. By means of a all bracket, the trap can be mounted top of the tuner, in place of the tag- ip originally specified, the feeder wires ing connected directly to it.

If wound strictly to specifications, the p should land somewhere in the IF ss band. However, by checking ainst a grid-dip oscillator, the coils n readily be knifed to resonate on Mc. Each coil will need to be shorted it, while the other is being checked, avoid ambiguity.

We have heard one or two tuners in hich instability has been encountered. one instance, the instability had more do with the IF amplifier and the ouble disappeared when the tuner out- t coil was loaded and the IF channel igned to give a broad response rather an a single prominence.

In another case, stability appeared to e improved by wiring an extra .001mfd. ypass directly between the 6U8 screen nd its own earthed cathode pin. In the ame tuner, the 6U8 plate lead was ooped up toward the grid feed circuit, nstead of being pushed down against he chassis, then out through the hole to he tuned output transformer. This ggravated grid-plate capacitance effects n the 6U8.

## LAYOUT, COMPONENTS

At the frequencies involved details of ayout can be quite significant, as also he choice of components. Only miniature ceramic capacitors should be used. mica or paper type being unsatisfactory.

The 5-position multi-bank switch is the most difficult and costly item in the tuner and is well worth saving on, if you can get together enough odd (but good) switch banks to serve the purpose.

While we used and specified 5-position switch sections, it would be entirely possible to build a tuner around 3 x 3 banks. They would need to be mounted with a common contact close to the relevant circuit points and the first pin. serving Channel 9, in the same position as shown for the original tuner.

The basic Channel 9 coils would not be affected significantly by the number of other contacts on the switch. In a 3-position wafer Channel 7 would necessarily occupy the adjacent position and hairpin loops, made up from about 1in of braid, would probably be necessary to resonate the incrementally tuned RF grid and plate circuits Channel 2 coils would remain substantially as specified.

Don't forget to wire the switch as indicated, so that unused coils in the aerial, grid and plate circuits are shorted out automatically.

In regard to the coil data, a slight error occurred in the table given for the tuner in the February issue. We stated that all oscillator coils were to be wound to a 1/8th inch internal diameter, whereas those for Channels 1 and 2 should actually be 3-16th inch. Fortunately, most constructors spotted the error, since the size of the coils was fairly evident from the photograph and was also inferred at the end of the article.

### by Neville Williams

Do not take the coil data for granted, however. While the oscillator coils can be put on to frequency in obvious fashion by squeezing or knifing the turns, extra signal strength can be realised by making sure that the RF grid and plate circuits are properly aligned

Their tuning is broad but nevertheless significant. While the effect of adjustments can be noted on the picture under low signal conditions, measurement of the AGC voltage with a VT voltmeter gives a much more conclusive indication.

In a simple AGC system, the control voltage will vary markedly with tuning and picture content but its general order can be assessed well enough by tuning each time to a specific region just clear of where sound streaks appear in the picture. Alternatively or as well—maximum and minimum AGC voltages for each station may be observed.

For purposes of test, the effective inductance of the coils can be reduced and the resonant frequency raised by slipping a brass bolt into the "cold" end of the coil. Alternatively, the metal tip of an alignment tool, touched on the RF grid or plate pin, will introduce small extra capacitance and lower the resonant frequency.

## TRIMMING THE COILS

If reduced inductance raises the signal strength, try opening out the coil or reducing the number of turns. If more capacitance appears to improve matters, squeeze the coil, or increase its diameter or add an extra turn to give the same end-result.

**At the frequencies involved, the unused section of the incremental circuit will have some bearing on alignment and final peaking should not be attempted before all coils are in position on the switch, together with the shorting link.**

Begin, therefore, by winding all coils to specification, solder them to the switch and then proceed to check alignment in detail.

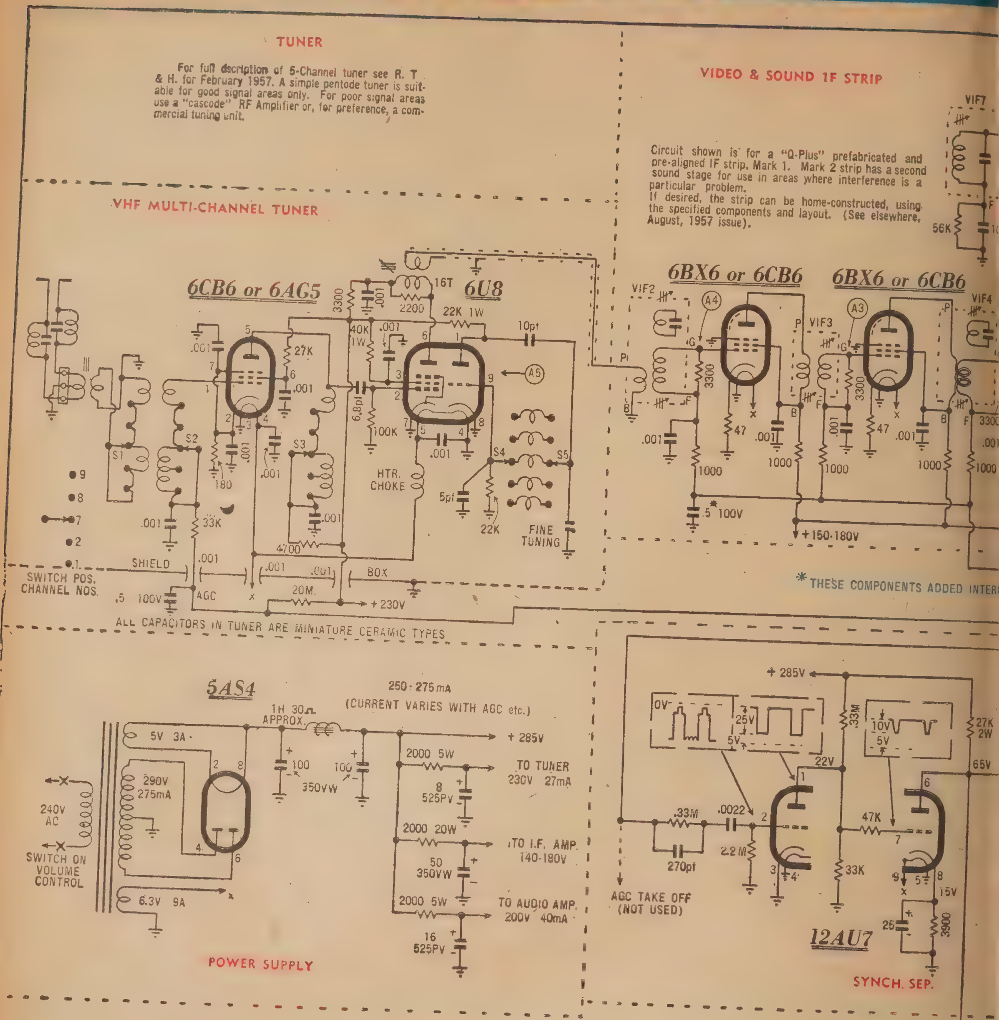
Check the Channel 9 aerial and RF coils first and peak them, using the methods already suggested.

Then switch to Channel 7. Any inductance variation which seems necessary must now be achieved by lengthening or shortening the links between the Channel 7 and Channel 9 contacts, leaving the basic Channel 9 coils untouched.

To obtain increased inductance, bend the links into a shallow arc and solder between the tips of the switch contacts. To reduce inductance use a direct link and solder between the contacts hard against the switch wafer.

The Channel 2 coils can be peaked

# REVISED DIAGRAM OF 17-INCH TV RECEIVER WIT



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6BX6 or 6CB6
6BX6 or 6CB6
VIF2
VIF3
VIF4
VIF7
A4
A3
A5
S1
S2
S3
S4
S5
HTR. CHOKE
FINE TUNING
16T
22K 1W
10pf
40K 1W
27K
100K
6.8pf
180
33K
4700
20M.
22K
5pf
3300
2200
.001
.5 100V
AGC
BOX
SHIELD
+230V
SWITCH POS.
CHANNEL NOS.
9
8
7
2
1
47
1000
3300
56K
.001
.5 100V
+150-180V
5AS4
1H 30Ω APPROX.
250-275mA
(CURRENT VARIES WITH AGC etc.)
5V 3A
290V 275mA
6.3V 9A
240V AC
SWITCH ON VOLUME CONTROL
100
350VW
+285V
2000 5W
TO TUNER 230V 27mA
8 525PV
2000 20W
TO I.F. AMP. 140-180V
50 350VW
2000 5W
TO AUDIO AMP. 200V 40mA
16 525PV
POWER SUPPLY
+285V
OV
25V
5V
22V
10V
5V
.33M
27K 2W
65V
.33M
.0022
2.2M
270pf
47K
33K
15V
25
3900
AGC TAKE OFF (NOT USED)
12AU7
SYNCH. SEP.

For full description of 5-Channel tuner see R. T & H. for February 1957. A simple pentode tuner is suitable for good signal areas only. For poor signal areas use a "cascode" RF Amplifier or, for preference, a commercial tuning unit.

Circuit shown is for a "Q-Plus" prefabricated and pre-aligned IF strip, Mark 1. Mark 2 strip has a second sound stage for use in areas where interference is a particular problem.

If desired, the strip can be home-constructed, using the specified components and layout. (See elsewhere, August, 1957 issue).

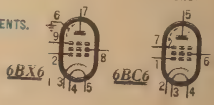
* THESE COMPONENTS ADDED INTER

ALL CAPACITORS IN TUNER ARE MINIATURE CERAMIC TYPES

## NOTES

1. ALL CAPACITOR VALUES ARE SHOWN IN MICROFARADS, UNLESS OTHERWISE MARKED.
2. ALL RESISTORS ARE HALF-WATT UNLESS OTHERWISE MARKED.
3. VOLTAGES ARE AS MEASURED IN PROTOTYPE CHASSIS, USING STANDARD TOLERANCE NOT DESIGN CENTRE COMPONENTS.
4. ALL RESISTOR VALUES ARE SHOWN IN OHMS UNLESS OTHERWISE MARKED. (M = MEG. K = x1000)
5. ┿ 1000VW

SOCKET CONNECTIONS.

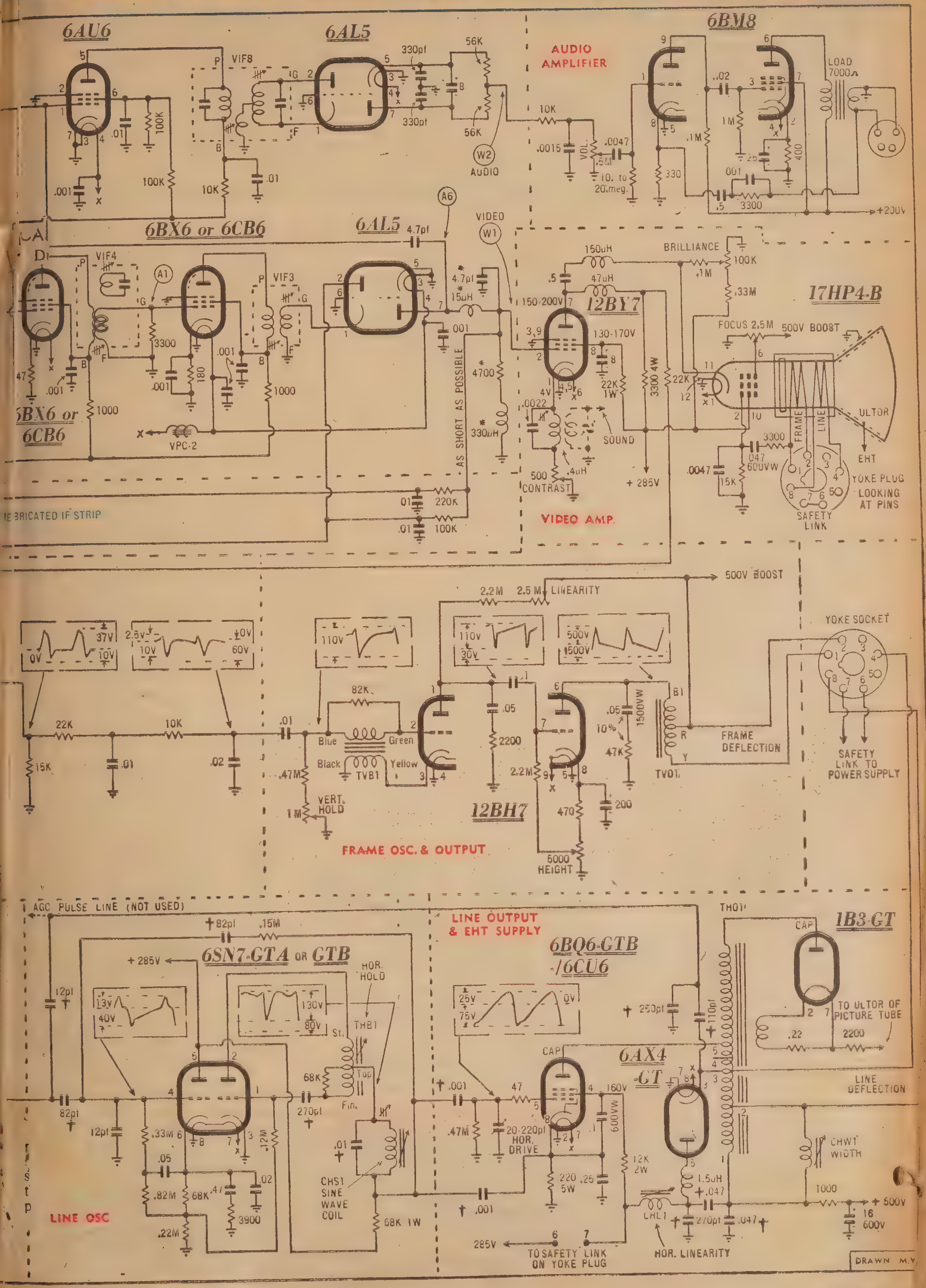


6BX6
6BC6
1
2
3
4
5
6
7
8
9

## 17-INCH TELEVISION RECEIVER

(PENTODE TUNER, SIMPLE AGC.)

# IMPORTANT VOLTAGES, VALUES AND WAVEFORMS


6AU6
6AL5
6BM8
AUDIO AMPLIFIER
VIF8
330pf
56K
10K
.0015
VOL. .5M
.0047
10. to 20.meg.
W2
AUDIO
LOAD 7000Ω
.02
1M
.1M
330
400
25
.001
.5
3300
+200V
100K
10K
.01
.001
6BX6 or 6CB6
6AL5
4.7pf
A6
VIDEO
W1
150uH
BRILLIANCE
100K
.1M
.33M
47uH
12BY7
17HP4-B
VIF4
A1
VIF3
4.7pf
15uH
150-200V
3300
180
1000
47
.001
5BX6 or 6CB6
VPC-2
4700
330uH
AS SHORT AS POSSIBLE
130-170V
22K 1W
3300 4W
22K
FOCUS 2.5M
500V BOOST
ULTOR
EHT
.0022
SOUND
.4uH
500 CONTRAST
+285V
.0047
15K
3300
.047 600VW
YOKE PLUG LOOKING AT PINS
SAFETY LINK
FRAME
LINE
VIDEO AMP.
220K
100K
FABRICATED IF STRIP
500V BOOST
2.2M
2.5 M LINEARITY
37V
0V
10V
2.5V
60V
110V
30V
500V
1500V
YOKE SOCKET
22K
10K
15K
.01
.02
82K
Blue
Green
Black
Yellow
TVB1
.47M
1M VERT. HOLD
.05
2200
12BH7
.05 10%
1500VW
47K
B1
R
Y
TVO1
FRAME DEFLECTION
SAFETY LINK TO POWER SUPPLY
470
200
5000 HEIGHT
FRAME OSC. & OUTPUT
AGC PULSE LINE (NOT USED)
82pf
.15M
12pf
+285V
6SN7-GTA or GTB
HOR. HOLD
13V
40V
130V
80V
THB1
St.
Fin.
Top
68K
270pf
.33M
12M
.05
.82M
68K
.47
3900
.02
.22M
.01
CHS1 SINE WAVE COIL
68K 1W
LINE OSC
LINE OUTPUT & EHT SUPPLY
6BQ6-GTB -/6CU6
25V
75V
0V
.001
47
.47M
20-220pf HOR. DRIVE
160V
600VW
220 5W
.25
.001
6AX4 -GT
12K 2W
THO1
1B3-GT
CAP
250pf
110pf
TO ULTOR OF PICTURE TUBE
.22
2200
LINE DEFLECTION
1.5uH
.047
270pf
.047
CHL1
HOR. LINEARITY
CHWT WIDTH
1000
+500V
16 600V
285V
TO SAFETY LINK ON YOKE PLUG
DRAWN M.V.

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| 212 .. .. .. .. .. .. .. .. | £11/-/- ea. |
| 215 .. .. .. .. .. .. .. .. | £15/10/- ea. |
| 104 .. .. .. .. .. .. .. .. | £15/-/- ea. |
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| U4H .. .. .. .. .. .. .. | £6/7/6 ea. |
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YOUR ORDER
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AND
RUSHED TO YOU

uite readily by knifing and spreading ne or both ends to obtain optimum inuctance.

One other point about the tuner is hat we show a loading resistor across he tuned output coil. Experience with he tuner feeding into various IF channels has shown the desirability of using uch a resistor to prevent the output coil rom having too much effect on the overall selectivity pattern of the IF channel. A value of 2200 ohms appears to be a good compromise and can well be added, as a matter of course, to existing homebuilt tuners.

## CASCODE TUNER

During the past month, we built up a second tuner to the same general pattern but using a "cascode" RF stage in place of the pentode. The new version worked well from the outset and needed only a touch up of the coils to produce good performance.

With both tuners available, we simply swapped from one to the other, looking for differences in behaviour, as evidenced in picture and sound.

Under these strictly practical conditions, the margin between the two appeared to be quite small, though it did favour the cascode. Since there is nothing to it in the matter of cost and complexity, any future tuners may just as well use the cascode arrangement.

On the other hand, if you have already built a pentode tuner, or want to use a pentode valve which is on hand, forget the newer circuit. Any benefit which it offers is unlikely to make the difference between a bad picture and a good picture. It isn't as much as that.

For the sake of those who may wish to try the cascode tuner, we reproduce the complete circuit diagram. For the most part, it follows the original circuit but a twin triode, with its relevant circuitry, replaces the pentode.

The cascode circuit has long been popular among the amateur fraternity for its low noise characteristic and near-phenomenal results have been obtained by the careful combination of valve types operating conditions, layout and neutralisation to secure optimum signal-to-noise ratio.

## TV REQUIREMENTS

In a television receiver, the more pressing need is for simplicity, a wide passband and adaptability for multi-channel operation. Commercial design has therefore gravitated around a few twin triode types, especially designed for this class of service.

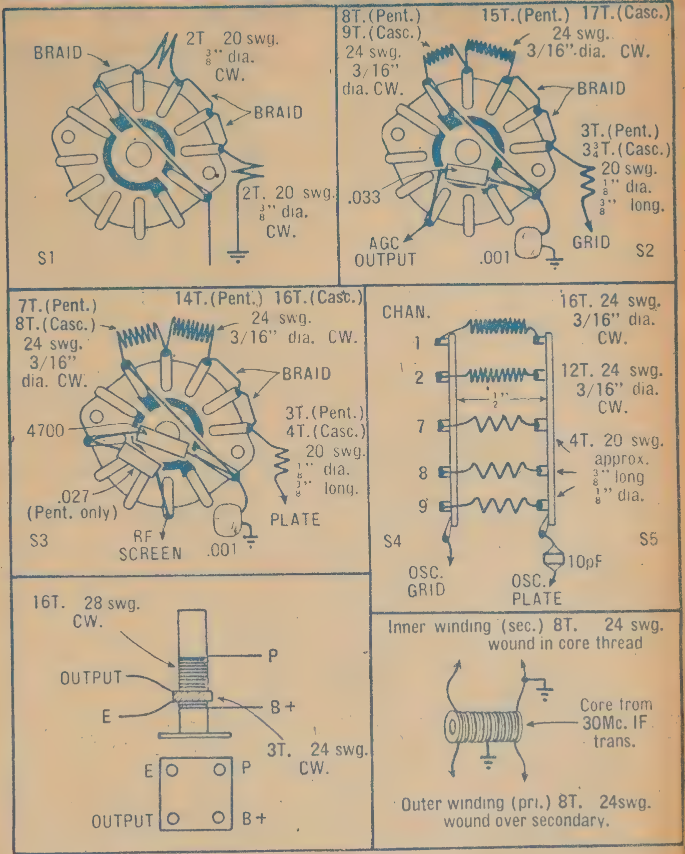
We have specified such a valve for the circuit, a type 6BQ7A, which is currently being used in many commercial receivers. We have also followed the common practice of connecting the two sections in series as far as DC supply is concerned.

The input circuit is quite conventional, signal being fed to the grid and initial bias generated at the cathode.

In the presence of input signal, the plate current of the first triode varies at signal frequency. The plate load for this section is not a tuned circuit; if it were the triode would oscillate due to grid-plate capacitance.

The variation in plate current is applied, rather, to develop a voltage across the cathode-grid-plate structure of the second triode, which is connected in series with it.

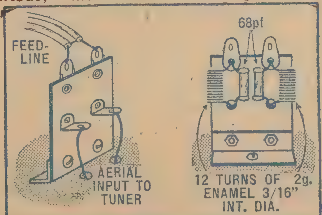
## DETAILS OF THE SWITCH WIRING


BRAID
2T 20 swg. 3/8" dia. CW.
BRAID
2T. 20 swg. 3/8" dia. CW.
S1
8T.(Pent.) 9T.(Casc.) 24 swg. 3/16" dia. CW.
15T.(Pent.) 17T.(Casc.) 24 swg. 3/16" dia. CW.
BRAID
3T.(Pent.) 3¾T.(Casc.) 20 swg. 1/8" dia. 3/8" long.
.033
AGC OUTPUT
.001
GRID
S2
7T.(Pent.) 8T.(Casc.) 24 swg. 3/16" dia. CW.
14T.(Pent.) 16T.(Casc.) 24 swg. 3/16" dia. CW.
BRAID
4700
3T.(Pent.) 4T.(Casc.) 20 swg. 1/8" dia. 3/8" long.
.027 (Pent. only)
S3
RF SCREEN
.001
PLATE
CHAN.
1
2
7
8
9
16T. 24 swg. 3/16" dia. CW.
12T. 24 swg. 3/16" dia. CW.
1/2"
4T. 20 swg. approx. 3/8" long 1/8" dia.
S4
S5
10pF
OSC. GRID
OSC. PLATE
16T. 28 swg. CW.
P
OUTPUT
E
B+
3T. 24 swg. CW.
E
P
OUTPUT
B+
Inner winding (sec.) 8T. 24 swg. wound in core thread
Core from 30Mc. IF trans.
Outer winding (pri.) 8T. 24swg. wound over secondary.

Here is the coil data for the .T. & H.. 5-channel tuner. It includes, with slight corrections, the original information for the pentode tuner, together with extra data for the cascode version. Figures refer to the inside diameter in every case and will be only valid if the original layout is followed in every detail.

The cathode input impedance of this second triode is quite low and the first section cannot develop enough plate signal voltage across it to become unstable due to plate-grid feedback.

At the same time, however, the signal voltage developed at the second cathode is quite adequate to drive the second triode, which functions as a grounded-grid-amplifier. This second stage gives good amplification, again without danger of instability, signal output appearing across the tuned plate circuit.


FEED-LINE
68pf
AERIAL INPUT TO TUNER
12 TURNS OF 2g. ENAMEL 3/16" INT. DIA.

Here are the essential details of an IF filter which can be connected in series with the aerial feedline. It mounts on top of the tuner in place of the original aerial connection tagstrip.

In point of fact, the second grid i grounded only for the signal frequency. As far as DC is concerned, it is held to a potential about half that of the HT supply. The directly coupled cathode and plate tend to stabilise automatically a about the same voltage level.

AGC applied to the first grid limit the current through both valves, givin an overall grid base somewhat longe than the usual high-frequency pentode

Physically, the cascode tuner differ very little from the pentode version an most of the constructional informatio given in the February 1957 issue sti applies.

Obviously enough, the valve hol tended for a 7-pin socket must be ope ed out enough to accommodate the pin socket required by the 6BQ7A

Mounting holes need to be drilled that 9-pin of the socket faces direct inward, bringing the input grid and ou

# CHANNEL MASTER

releases the

# T-W

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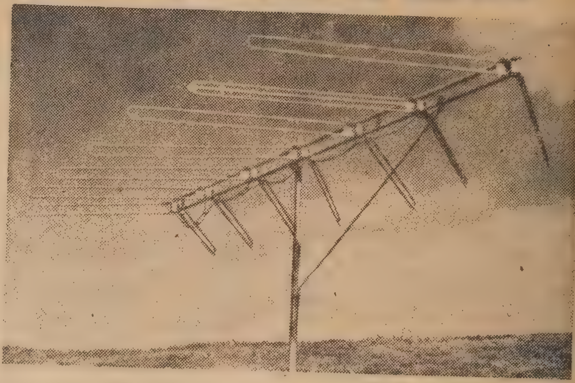


T.W, 7 Element Model 350

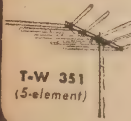
WHAT THE "TRAVELLING WAVE" PRINCIPLE MEANS

- Ideal phase relationships on all channels.
- Optimum impedance matching on all channels.
- Equal flow of current in all dipoles on all channels.
- Fullest use of transmitted energy on all channels — all elements except reflector are "driven."

***IN SHORT — FABULOUS PERFORMANCE ON ALL CHANNELS***

**SENSATIONAL 3 AND 5-ELEMENT MODELS!**

Amazing T-W performance for suburban and near-fringe areas, too! Wonderfully compact and rugged!



**T-W 351**
*(5-element)*

**T-W 352**
*(3-element)*

## Revolutionary new design provides picture quality never before possible

**After two years of research—a completely new kind of VHF Aerial, operating on revolutionary new electronic principles. The T-W is Channel Master's greatest achievement.**

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### CHANNEL MASTER LEADS THE WORLD IN TELEVISION AERIAL RESEARCH

Only Channel Master could produce an aerial like the T-W. Enormous facilities for research and field testing were required. American problems of vast spaces and the need for taking reception over wider areas are the same as in Australia. Channel Master's Australian engineers feed survey information, meteorological data, contour maps, etc., to the American laboratories. The result is a service to Australian installation companies and radio retailers that is incomparable. Any problems you may have, call Channel, Master — they have the answers.

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**Vic.—W. Franki (Melb.) Ltd., 380 Bourke St. Melbourne.**

***Manufactured by* CHANNEL MASTER PTY. LTD. (Inc. in Vic.)**
**752 PITTWATER ROAD, BROOKVALE. XW0221 182 YORK STREET, MELBOURNE. MX6512.**
***World's Largest TV Aerial Manufacturers***

put plate pins close to the relevant switch sections.

The small diagram reproduced herewith shows the location of components around the 6BQ7A socket. All other components occupy the same positions as specified for the original pentode tuner.

Capacitances associated with the cascode are slightly lower than the pentode and allow some increase in the inductance of the grid and plate coils. We have modified the data accordingly to cover both versions.

The cascode tuner also draws slightly less current than the pentode and therefore operates at slightly higher voltage through the specified dropping resistor This is quite in order.

## FINE TUNING

While constructing the new tuner, we took the opportunity of replacing the original gear-driven fine tuning capacitor with a shaped vane, as used in many commercial tuners. While the capacitor is the easier method — if you have the capacitor — the vane idea was shown to be quite practical and can be used on either version of the tuner.

The method adopted was to punch an octal valve hole in the front of the tuner box in the position shown. A scrap of 1/8th perspex was mounted behind the hole, held at one corner by the switch rod and at the other by an additional bolt.

A further scrap of perspex was cut to a circle which just fitted the valve hole. Purpose of this second piece was to support the fixed plate out from the face of the box.

The accompanying sketch shows, full size, the shape of the fixed plate and the moving vane.

This latter was drilled next, to be a tight push fit over a length of tubing concentric with the switch shaft. By rotating the vane, it was then possible to select a position for the fixed plate, on the perspex support, such that the vane progressively obscured more of it as the shaft rotated through 180 degrees.

Having selected the position, we drilled straight through the fixed plate and both layers of perspex. The fixed plate was then indented to receive the head of a countersunk bolt and the outer disc of perspex was countersunk to receive the indentation. A single nut lug on the inside held everything together and provided means for connecting the fixed plate to the oscillator circuit, as required.

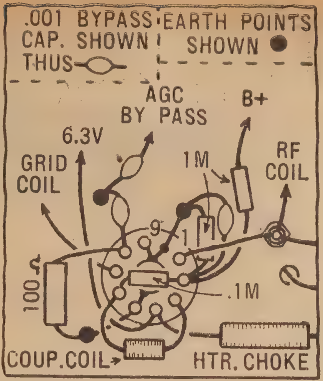
## CLEARANCE

For suitable capacitance variation, the vane in our case needed to clear the fixed plate by about 3/32 inch and it was duly aligned and sweated to the tube so that it could occupy this position.

To maintain tension on the vane, we looped a small brass bracket over the top edge of the tuner box, with a clearance hole for the switch shaft. A spiral spring from a valve can, slipped over the shaft and behind the bracket, is enough to force it out at moderate pressure.

The vane, on its tube was simply forced in against this springy bracket and retained by cutting a ring in the switch shaft to take a circlip from a discarded potentiometer.

So much then for discussion of the tuner, which has almost assumed the proportions of an article in its own right. But why worry? Our purpose this month is simply to discuss aspects of the design, as they have arisen out of earlier articles, and without any special preoccupation with sequence.

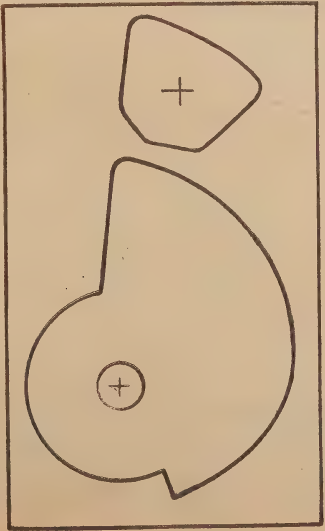


This layout diagram shows the disposition of components around the 6BQ7A socket in the cascode version of the R.T. & H. TV tuner. It should be used in conjunction with the diagram on page 65 of the February, 1957, issue.

For those who may find difficulty in obtaining a miniature capacitor for fine tuning, the idea illustrated above is perfectly satisfactory. The springy bracket should be made slightly convex and exert just enough pressure on the vane to allow smooth movement without binding.

☆

These outline diagrams are exact full-size copies of the original brass vane and fixed plate. Their shape was determined by inspection and does not necessarily follow a precise law

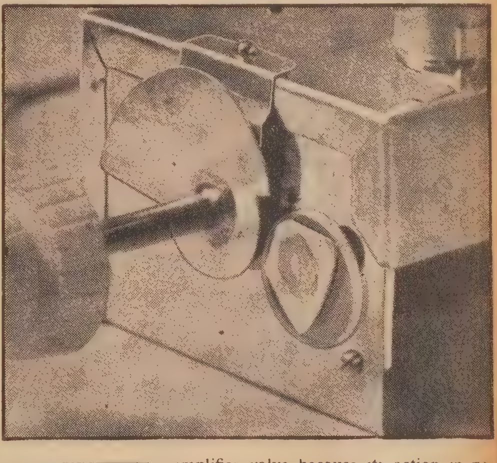


As far as the IF amplifier is concerned, we didn't even try to include it in this article. We passed the whole project over to Phil Watson and the result of his labours appears elsewhere in the issue.

Small points like heater bypassing have been rationalised by discussion with the components manufacturer and the information included on the circuit. Nothing more need be said here about the basic IF amplifier.

In an earlier issue, we mentioned the possibility of feeding the intercarrier sound strip from the trap circuit in the video cathode, rather than directly from the video detector. This is done in some commercial receivers, partly with the idea of minimising loading on the detector and partly to obtain a small amount of "free" 5.5 Mc amplification. (The secondary winding is shown dotted in our circuit.)

In point of fact, no voltage amplification can be obtained from the video amplifier valve because its action in respect to the 5.5 Mc component can only be that of a cathode follower with a gain probably a good deal less than unity. Any voltage step-up must be obtained by ensuring that the tuned winding feeding the intercarrier grid has many more turns than the trap. In other words, it must have a substantially higher L/C ratio.



As a quick check from the home builder's point of view, we tried winding a trap on a Q-plus VIF7 coil, which already has a high impedance winding intended to resonate at 5.5Mc. The trap was wound about ¼in above the existing winding and trimmed so that the core would peak about half-way in. The two coils must not be placed too close, of course, otherwise the efficiency of the trap may be impaired.

The chassis layout is such that the intercarrier sound channel can be [illegible] readily from the modified trap coi[illegible] coupling to it through a small capacitor instead of back to the video detector.

On this admittedly tentative basis, the scheme seemed to offer only slight advantage and had to be abandoned for the time, in the face of more urgent matters. We gained the impression that i

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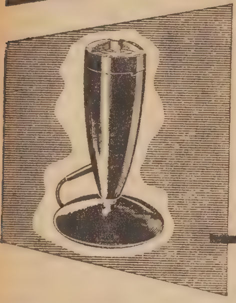

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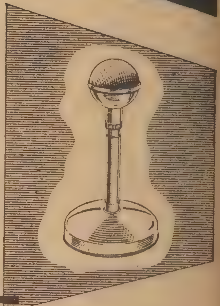
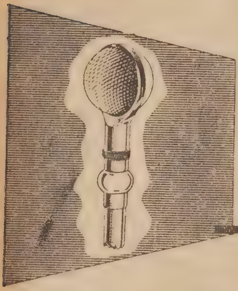


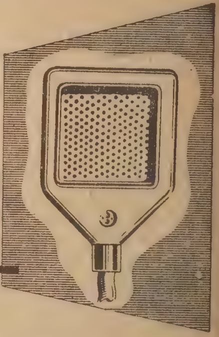
### TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost **PRICE, £9/18/6.**



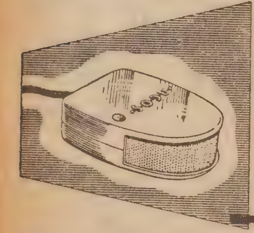
### HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise **PRICE, £24/19/6.**



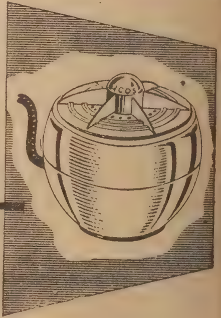
### LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



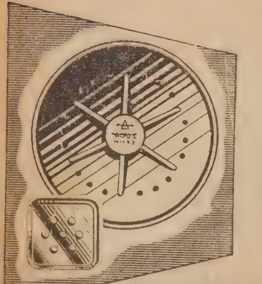
### GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s **PRICE, £2/15/-.**



### HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



*(MIC32 illustrated)*
*(MIC23 illustrated)*

### CRYSTAL MICROPHONE INSERTS

These inserts are available in varying sizes, ranging from as small as $\frac{15}{16}$ in. square to 1-$\frac{13}{16}$ in. round, with various thicknesses from $\frac{7}{32}$ in. to $\frac{9}{16}$ in. Suitable for every purpose, such as hearing aids, public address, tape recording, amateur transmitters, etc., they have responses from 2,250 c.p.s. to 3,500 c.p.s. at -5 db to -30 db. Insert can be supplied with or without 10 meg. resistor as required.

MIC19/4 and MIC32, **£2/15/6;** all others, **£1/19/6.**

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ccess would depend of having just the ght kind of step-up transformer, pre- ably mounted in the IF strip and ding directly to the first inter-carrier id.

The video amplifier, the contrast con ol and the intercarrier amplifier are fficiently close to allow this to be ne.

We may have more to say about it ter if such a transformer comes to nd or if we are able to do more work it ourselves.

What we have said, however, may rve as a guide to any constructor who ay wish to experiment along these ne

Mention was also made in the iginal circuit of the possibility of ad ng an extra stage to the intercarrier und channel for use in fringe areas his is an important matter and we have one to some trouble, in the last couple f weeks, to assess its likely significance the home constructor

## RACTICAL TESTS

To this end, we set up the prototype ceiver in an area of only moderate gnal strength then progressively re uced the signal input by degrading the erial and/or operating the receiver ith no aerial at all.

Under these conditions it was pos ble to get the signal level so low that e picture on the screen was either on-existent or barely discernible. At ll times, however, the sound channel emained clearly operative, though with ome background noise.

Switching on an electric drill nearby ut an obvious interference pattern n the screen but the power cord ad to be brought right against the erial input terminals before any sign f noise could be heard in the loud peaker

In other words, with the single 5.5 Mc amplifier stage as in the original eceiver, the resolution and noise rejec ion characteristics of the sound channel were clearly better than the picture hannel and there was no question of onditions arising where picture would e available but not sound

**It must be stressed, however, that these observations were made with the IF channel properly aligned and with a correctly placed sound plateau. If the pass band of the IF channel is too narrow, or the sound plateau is non-existent, there may be trouble with inadequate sound level, or frame buzz or difficulty in tuning picture and sound together.**

These are problems of component design or regeneration or alignment, ather than the mere number of stages nvolved The fact remains that, in a properly adjusted receiver the results were as stated

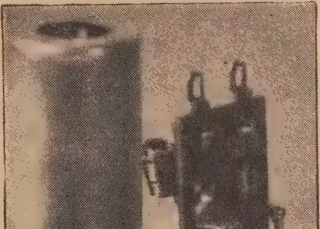
In the face of such observations, it is rather hard to make a convincing case for an extra sound stage. Nevertheless to satisfy our curiosity we made the necessary additions.

Physically, it involves mounting a VIF7 coil and a 6AU6 valve in the holes provided for them, in front of the existing 5.5 Mc amplifier. The layout is not above criticism when this is done, because the 5.5 Mc signal lead has to be taken back down the centre of the channel, from the video detector to the first 6AU6 grid.

We talked this over with the manufacturer who claimed that no trouble had been encountered with the lead. Furthermore, it was pointed out that some commercial receiver manufacturers have entirely separate picture and sound strips with much longer connecting leads between them The designer of the Q-plus strip was presumably much more concerned with avoiding mechanical differences between the Mark I and Mark II strips and with maintaining external input and output connections at opposite ends

## MERELY ADD COMPONENTS

Unless the constructor is keen, therefore, to turn the whole sound channel end-for-end, the only course is to place the extra valve and coil in the holes left vacant for them and to wire accordingly. The lead from the video detector can either be run straight up the centre of the chassis underneath or else through holes and above the chassis for most of the distance.



This picture shows the IF trap in position on the tuner, in place of the original tagstrip. The feed wires connect to the two top lugs.

# ADJUSTING ION-TRAP MAGNETS

Last month we outlined briefly a method for setting the ion trap magnet on the 17HP4B picture tube. Here is a more detailed procedure, as recommended by RCA

*This note describes a recommended procedure for adjusting ion-trap magnets to obtain maximum picture brightness and to minimise the possibility of damage to picture tubes.*

*Misadjustments of the ion-trap magnet may cause imperfect centring of the picture tube electron beam and result in excessive bombardment of the masking aperture within the electron gun. As a result of such bombardment, ions may be formed beyond the control of the ion-trap and produce an ion spot on the fluorescent screen.*

## Recommended procedure

*1. Centre the deflecting yoke on the tube neck and press the mounting-bracket cushion firmly against the glass funnel. For a tube using electrostatic focus, a small adjustable centring magnet is usually required It should be placed on the tube as recommended.*

*2. Place the ion-trap magnet on the tube neck. The initial position of the magnet should be in accordance with the instructions given in the data for the specific tube type*

*3. Adjust the brightness control midway between its minimum and maximum positions and set the contrast control to minimum.*

*4. With the controls set as indicated apply operating voltages to the tube. As soon as the tube cathode reaches operating temperature, adjust the position of the ion-trap magnet by moving it a short distance forward or backward and rotating it slightly until maximum brightness is obtained at the centre of the raster.*

*It is important that this adjustment be made with the brightness control set as specified in (3) midway between the minimum and maximum positions so as to keep the beam current low. It is equally important that the adjustment of the ion trap-magnet be completed quickly because operation of the picture tube with the ion-trap magnet improperly positioned may damage the tube.*

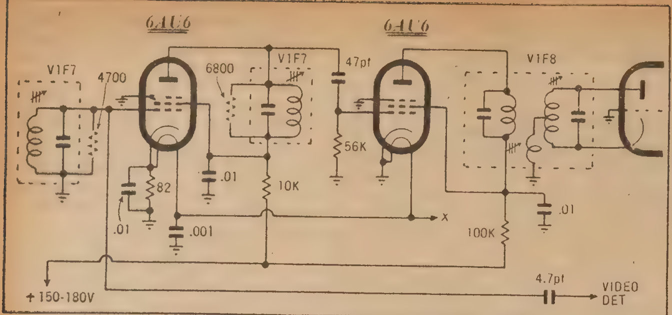
*With certain picture tubes, particularly those utilizing electrostatic focus, two positions of the ion-trap magnet may be found in which maximum brightness is produced. The correct position is that which is nearer the base of the tube.*

*5. Focus the pattern and centre it. If a shadow appears at the edge of the raster, check the position of the deflecting yoke to make sure that it bears firmly against the glass funnel and centred on the picture tube neck.*

*If any shadow remains, eliminate it by adjusting the position of the centring magnet. If this adjustment reduces maximum brightness at the centre of the screen or disturbs centring and focus, repeat steps (4) and (5). Never adjust the ion-trap magnet to centre the pattern; never adjust it to eliminate neck shadow if such adjustment reduces the brightness at the centre of the screen.*

*6. With the picture control in its minimum position, turn the brightness control to its maximum setting and readjust the ion-trap magnet as indicated in (4) until maximum light output at the centre of the raster is again obtained. Bowing of opposite sides of the raster in the same direction may occur if the ion-trap magnet has improper rotational position.*

*7. Adjust the brightness and contrast controls to obtain a picture of normal brightness. Readjust centring and focus if necessary. If this step requires any appreciable change in centring or focus, repeat operation (6) to recheck position of the ion-trap magnet*



Here are the circuit details for the extra intercarrier IF stage. We used shunt resistors across the windings for complete stability, though they are not specified by the manufacturer. We also used a 100K resistor to feed the second valve, as against the manufacturer's figure of 22K.

The extra coil and socket must be orientated, of course, to keep the other leads short.

The circuit used is shown in the accompanying diagram and differs somewhat from that recommended by the manufacturer. Note that a .001 mfd bypass is specified at the heater pin of the extra 6AU6, being transferred, if you like, from the existing 6AU6.

In our particular case, the augmented channel showed signs of regeneration, which is never a good thing where FM sound is concerned. At certain critical core settings it was, in fact, possible to promote active oscillation. This was not evident as an audible sound from the speaker but it showed up as a sudden jump in limiter grid current and an equally sudden drop in sound level with accompanying distortion.

To secure complete stability, we found it desirable to shunt the circuits as shown dotted. This is not done in the ready-built Mark II units and we are rather at a loss to explain the discrepancy. However, it is a simple matter to add or omit loading resistors, as seems necessary in individual cases.

Aligning the two-stage strip needs a little more care than the simpler version, because the limiter action blankets the effect of the adjustments. It alig ing on the station, a simple method to clip a lead from a VTVM throu a 1-meg. isolating resistor to the g pin of the limiter valve. This will g quite clear indication as to the alig ment of all preceding circuits.

Now transfer the lead to the ra detector output. Assuming that the ra detector is slightly unbalanced, the p mary of the transformer can be tun for maximum deflection and the secon ary for balance or zero DC output.

But what of performance?

In practice, the difference betwe the simple and more complex sou channel was not immediately obvio There was little change in the norm setting of the volume control and obvious change in signal-to-noise rat under ordinary signal conditions. On when the signal input was reduc again to the point where the pictu was disappearing was there any pe ceptible improvement in signal-to-noi ratio

## NO FRAME BUZZ

The main point of difference appea to be in the ability of the sour channel to produce adequate outp with wide variation in the Fine Tunir Control. It could be made to produc intercarrier buzz only with difficult and the sound was retained to quite u likely limits of picture tuning.

In other words, the extra stage car not be recommended on the basis more or better sound in a well-adjuste receiver. Its main effect is to allo more tolerance against inaccurat alignment or poor tuning by non-tec nical members of the household.

If you think that such a reward worth the cost and effort, you can mak the addition.

So much for the sound channel

Last month we mentioned the possi bility of adding Keyed AGC to the re ceiver in place of the simple circuit. was our intention to do this but, throug pressure of other work, we have simpl not been able to manage it. Any reade who is impatient to try out the schem can refer to the provisional circuit o page 99 of the May issue.

It should work but, of course, onl actual trial can reveal any unsuspecte complications.

**It should be noted in passing that keyed AGC will not contribute anything to the ultimate sensitivity of the receiver and its inclusion is therefore not warranted, merely because the receiver is to be used in a fringe area.**

On the contrary, its value is more likely to be apparent in strong signal areas, where the simple system may be hard put to it to limit gain sufficiently. Keyed AGC is also amplified AGC and gives good control of front-end gain in areas of high signal level.

## SMALL COMPONENTS

One other point about the circuit warrants special mention. When originally released, the supply position on many small components was difficult, to say the least. Quite deliberately, therefore, we refrained from making hard and fast specifications on voltage ratings, preferring to take a calculated risk.

Accordingly, we assumed the use of ordinary mica capacitors throughout the

(Continued on page 127)

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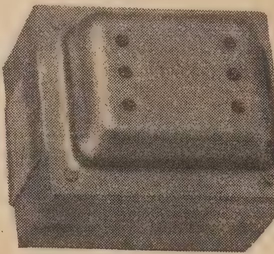

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# A SIMPLE COURSE IN RADIO — 8

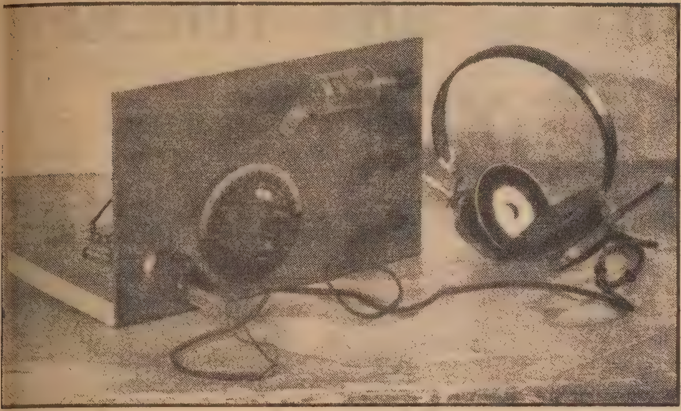


Figure 1. A home-made crystal set like this one is about the simplest practical receiver. For all its simplicity, however, it can illustrate practically many basic facts. If you've never built a crystal set, now is the time to start.

**Electric and magnetic effects in space. Changing fields, a fixed conductor and induced current. The tuned circuit, aerial coupling and the selection of signals. Values of inductance and capacitance. How earphones work. Detection and the audio signal. A complete crystal receiver circuit.**

# The How and Why of Radio Reception

Last month we described the process of radio transmission; how code, speech and music can be carried by radio waves over great distances. In this article we see what happens at the other end, how those same radio waves are intercepted, selected and changed back into the sounds we want to hear

TO get a clearer picture of how a receiver operates it may be helpful to retrace our steps a little and to think again of the way in which radio energy can be broadcast or radiated into space. The reader may then be better able to understand how such energy can be intercepted.

Last month we likened a transmitting aerial to a huge tuned circuit surrounded, in operation, by alternating electrostatic and magnetic fields. We pointed out that these fields might extend for hundreds, even thousands of miles.

## ELECTRIC FIELDS

Many find this difficult to comprehend, because electrical energy is so intangible, particularly when there are no wire circuits to carry it. As it happens, however, one doesn't need to search very far to find quite homely illustrations of how electrical energy can bridge empty space.

Everyone is familiar, for example, with the old trick of rubbing an ebonite or plastic rule against dry cloth and seeing it attract small scraps of paper from the surface of a table.

A lecturer might explain the effect as due to the attraction between two bodies carrying an unlike electrical charge. This would be true but, for our present purpose, it illustrates graphically the fact that an electrical charge can exert an influence THROUGH SPACE, even though it may only be over a few inches in this particular case. But that is not all.

There is the equally familiar case of a permanent magnet and the way in which it can attract to itself small iron and steel objects, like needles and nails. Just what the force of magnetism is baffles even the scientists, but there is no denying its effect.

Nor is the effect of a magnet measurable only in inches. Bring a magnet within many feet of a sensitive compass and the needle will deviate perceptibly from its normal reading, depending on the way in which the magnet poles happen to lie in respect to the earth's magnetic field.

Of course a permanent magnet has a steady undirectional field, but we can easily change that. If the magnet is rotated in the appropriate fashion its field will rotate—or alternate—also and the compass needle will swing to and fro. Or we could gain the same effect by substituting an electromagnet and passing through it a slowly alternating current. The compass needle would again swing to and fro.

But here is the vital point of the illustration: There is no tangible connection between magnet and compass, just a magnetic field ACTING THROUGH SPACE. One could very rightly regard the magnet and its manipulations as a transmitter of energy and the compass needle as a receiver, reacting to its influence.

## AIR NOT NEEDED

And remember, it would act just the same if magnet and compass were both in a vacuum. Not even air is necessary to sustain electrical phenomena.

Now substitute for the magnet, in your thinking, a transmitting aerial which can produce a much more powerful magnetic field and an electrostatic field as well, alternating or varying at a frequency determined by the transmitter. (See figure 2.)

Substitute for the compass needle a receiver, which is much more sensitive to such variations, and you have the picture. The same kind of forces which you can so easily demonstrate over a distance of inches or feet are shown to operate over vastly greater distances, given the right kind of apparatus.

Having made that point we can recall something else from an earlier lesson which will also help explain the process of radio reception.

Think back to Chapter 3 and the discussion of inductance, coils, generators and such like. Remember the general law that "an EMF is always induced in a fixed conductor, which is cut by moving lines of force or, yet again, in a conductor which itself moves through a stationary magnetic field."

Perhaps it might have been better had we said "changing" rather than "moving" lines of force.

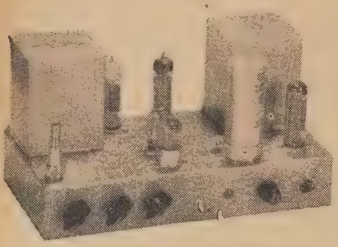
The first step toward radio reception is to provide an aerial, which may range from a rather pretentious installation to a mere length of wire tacked to the picture rail. This constitutes a "fixed conductor."

## AERIAL RADIATION

When a distant transmitter commences operation, it creates a weak but nevertheless definite alternating magnetic and electric field in space, and therefore in the vicinity of the receiving aerial.

In other words, we have a fixed con-

# HI-FI AMPLIFIERS AND TUNERS



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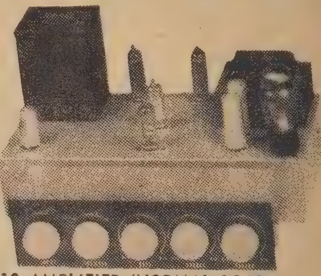

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> *Sgd. J. R. Goldthorpe."*

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ictor and a moving (or changing) field. f necessity, a current and voltage must induced in the aerial. Obviously ough, this induced current and voltage ill alternate in step with the signal from e transmitter, at the same "carrier" equency.

If the transmitted signal is amplitude odulated, rising and falling in strength, en the signal induced in the aerial will o likewise. If the transmitted signal is equency modulated, varying to either de of the nominal figure, then the inced signal at the receiving end will ry also.

In other words, our signal has arrived!

## IGNAL SELECTION

But a problem immediately presents self: How can an aerial distinguish beveen the wanted signal and others hich may be arriving simultaneously om other transmitters?

The answer? It doesn't!

An aerial is more or less receptive to ll signals and, at any one instant, it ay have induced in it current and voltge originated, not just by two or three. ut by hundreds of radio stations. The rocess of selecting the wanted signal is erformed in the receiver by something lse we learned about earlier—by a tuned ircuit.

You will find all about tuned circuits n Chapter 5, but, just to refresh your nemory, they involve an inductor and apacitor connected normally in parallel. When a current is initiated in the inductor, the resulting magnetic field generates a potential which charges the capacitor.

The capacitor then discharges back hrough the inductor, creating a new nagnetic field opposite in sense to the irst one. When the capacitor has discharged, the magnetic field begins to collapse and, in so doing, charges the capacitor in the reverse direction. Then the charge begins to flow back through the inductor and creates a new field. So the process continues, as explained earlier, to produce a damped oscillation.

This oscillation has a natural frequency which is governed by the amount of capacitance and inductance in the circuit. Increasing the value of either one (or both) lowers the so-called "resonant" frequency, while decreasing the value (or values) raises the resonant frequency.

This natural oscillation in a tuned circuit can be promoted and sustained by feeding into it energy or pulses with a corresponding repetition rate. It will not respond in the same way to energy or pulses having a completely different repetition rate.

## MECHANICAL ANALOGY

In this respect, the behaviour of a tuned circuit can be likened to the mechanical oscillation of a child's swing. Quite mild pushes, properly timed, can keep the swing moving freely. On the other hand, a great deal of energy can be expended to no purpose by trying to make the swing oscillate at other than its natural frequency.

To change the oscillation rate, it is necessary to vary the weight on the swing or the length of the ropes.

So it is with a tuned circuit or, should we call it, a tuning circuit? It will oscillate readily at its own resonant frequency but not at any other.

Now have a look at figure 3a. It depicts a tuning circuit, with one side connected to earth and with an aerial running to a tapping on the inductor, or coil, if you prefer the latter term.

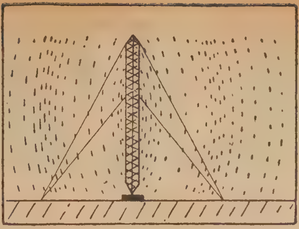


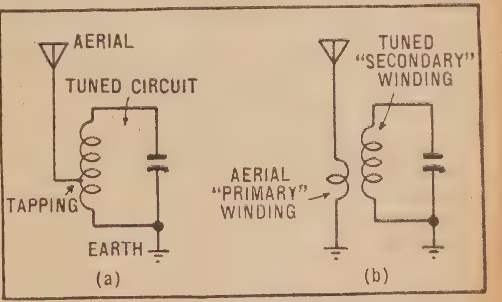
Figure 2: We reprinted this circuit from last issue to recall the way in which radio energy is broadcast. A transmitting aerial may be likened to a huge tuned circuit which creates electric and magnetic fields in the space surrounding it.

There are two points of immediate interest in this simple circuit.

In the first place the natural path for signal currents picked up in an aerial is between aerial and earth. Therefore the logical step is to provide a path from aerial, through portion of the tuned circuit, to an earth connection.

The second point is that an aerial is very seldom connected directly to the active end of a tuning coil. To begin with, an aerial has its own inductive and capacitive qualities and these, connected directly to the tuned circuit, can drastically alter its intended tuning range.

Figure 3: This diagram illustrates two popular methods of connecting a receiving aerial to a tuned circuit. Method (a) involves a tapping on the coil; (b) shows a "primary" winding adjacent to the earthed end of the tuned coil, which is often referred to as the "secondary" in such a case.



But no less important is the fact that an aerial does not retain energy within itself, as a tuning circuit tends to do. Even though erected with the idea of receiving signals, an aerial may radiate and therefore lose some of the oscillatory energy present in the circuit to which it is connected.

The end result is that a tuned circuit which is heavily "loaded" by the receiving aerial may be less efficient than one which is not so heavily loaded. This being so, it is common practice to connect the aerial across only a small portion of the tuning coil.

Alternatively, the aerial may be coupled to it by means of a small winding adjacent to the earthed end of the coil. This is illustrated in sketch 3b.

Now let's see how it all works out. The various voltages and currents induced in the aerial are fed into the tower end of the coil, while traversing the aerial-to-earth circuit. By magnetic induction some of the energy is coupled to the remaining turns of the coil, but not very effectively, because the vast majority of the incoming signals bear no relationship to the natural resonance of the tuned circuit.

However, let us say that among the incoming signals is one having a frequency of 1,000 kilocycles per second, normally written 1,000Kc. We could have picked any other figure, of course, but 1,000Kc is a nice easy one which happens to be in the centre of the broadcast band.

If we wanted to select this signal from the rest the proper course would be to adjust the tuning circuit so that its natural resonance would be at this same figure. This brings about a special state of affairs.

A particular half-cycle of the 1,000Kc signal may initiate a current through the coil, create a magnetic field around the coil and apply a small charge to the tuning capacitor. Then, as the half-cycle of signal ends, the field around the coil begins to collapse, a counter EMF is generated by the collapsing field and a reverse charge is applied to the capacitor.

## NATURAL RESONANCE

But because the natural resonance of the tuned circuit is equal to that of the incoming signal at 1,000Kc, the rate at which the field collapses and reverses is precisely the same as the rate of change of the incoming signal. Thus each succeeding half-cycle of the circuit's natural oscillation is supplemented by a corresponding alternation of the incoming signal.

Therefore, while incoming signals at all other frequencies have little obvious effect, the signal which happens to correspond with the resonance of the tuned circuit builds up across it a sustained oscillatory signal. Putting it another way, we might suggest that a tuned circuit responds to the signal to which it happens to be tuned and discriminates against signals on other frequencies.

This is a general statement, which must be qualified to avoid giving the wrong impression. A practical tuned circuit may not be able to discriminate completely against all unwanted signals in all circumstances. This applies particularly to very strong signals which are close in frequency to the wanted signal.

The ability of a tuned circuit to select a wanted signal and reject others having a different frequency is commonly referred to as its SELECTIVITY.

Herein lies the explanation of something that mystifies most newcomers to radio—how turning the shaft of a variable capacitor can tune signals in a[illegible] out.

Now you should know! Turning the shaft changes the capacitance of the variable capacitor (or condenser, if you like to call it so) and alters the resonant frequency of one (or more) tuned circuits. In so doing, the circuit (or circuits)

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### *(Designed for use in T.V. circuit published by Philips Elect. Ind. Pty. Ltd.)*

**POWER TRANSFORMER: DESIGN P.T. 1790**
Primary 200 230, 240V 50 cps
Secondary 230-CT-230V @ 350 mA
Filaments 2 x 6.3V @ 6 A

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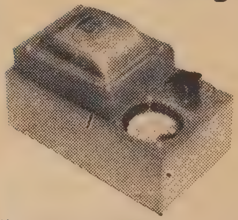
## T.V. Voltage Adjusters



AVAILABLE IN BOTH AUTO WOUND AND DOUBLE WOUND MODELS WITH OR WITHOUT 0-250 v METER FITTED.

Designed primarily as aids to servicemen in installing and servicing television receivers these Voltage adjuster units are now being used in other applications such as correction of input voltages to Amateur transmitting and receiving gear tape recorders, Hi-Fi audio equipment, etc where the load imposed is within the capacity of the adjusters

### AUTO MODEL TYPE: A.T. 1215 (illustrated)

Input voltage (50 cycle A.C.) 190 195 200, 205, 210, 220 230 or 240 adjustable by means of tapping switch. Input connector Bakelite 3-wire type enabling any convenient length of mains cord to be used Output voltage 200 to 240 as selected internally Output power 300 V.A (maximum output current 1.3 A.) Output voltage indicator 0-250V A.C Meter (Optional) Output socket standard 3-pin flush type Weight including meter 7½lb

### DOUBLE WOUND MODEL TYPE: P.T. 1832

Input voltage as for Auto model input connector as for Auto model Output voltage: 200 230, 240 as selected internally Output power: 200 V.A. (Maximum output current 0.8 A.) Output voltage indicator as for Auto model. Output socket standard 3-pin flush type Weight including meter 11lb

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But this leads to another question, which may as well be answered before we go on. How does one ensure that a circuit will tune to a particular signal? How does one determine a suitable value of inductance and capacitance? The answer is simple enough.

No one combination of inductor and capacitor will tune to all possible signal frequencies. Any given combination will only tune over a certain band of frequencies which, in practice, seldom exceeds a ratio of 4:1. That is to say, the highest frequency to which a circuit will tune is seldom more than four times the lowest frequency.

## TUNING BAND

This being so, it is usual to select values of inductance and capacitance in a receiver such that they will tune over the band of frequencies which includes the stations we most want to hear.

By way of example, ordinary "medium wave" broadcast stations throughout the world occupy the frequency band between about 550 and 1600 Kc, a ratio of just under 3:1. It is thus possible to tune over the entire broadcast band with a combination of one suitable inductor and one variable capacitor.

If it is desired to tune to short-wave (that is, higher frequency) signals, a new inductor must be substituted, to work with the variable capacitor.

By more or less common consent and practice, most capacitors intended for ordinary radio receivers have a maximum capacitance of about 425pF (picofarads or micromicrofarads) and a minimum of about 15pF.

The inductance of tuning coils is also fairly standardised, although less frequently quoted. The would-be constructor need only ask for a particular type of "broadcast" soil to be fully understood.

For many simple home-made receivers, the coils can be home-wound, and the question arises as to how the constructor can secure the right order of inductance in such a coil.

Again the answer is simple enough.

Where a home-wound coil is intended, instructions are normally given as to the diameter of the former to be used, the gauge and type of wire, the method of winding and the number of turns. Provided the instructions are correct—as they should be—and are followed, the resulting coil must have the right order of inductance.

## MODULATION

And, if it is associated with a tuning capacitor having the appropriate minimum and maximum capacitance figures, it is more or less inevitable that the combination will tune across the appropriate band of frequencies.

So, then, we have traced the wanted signal from the transmitter and transmitting aerial, through space to the receiving aerial, and thence into a tuned circuit which selects it and rejects others which may be present.

If the original signal is modulated, varying in strength at an audio rate, then it is reasonable to assume that the strength of oscillation induced in the tuned receiving circuit will vary in the same way. In other words, we should be able to find across the tuned circuit a modulated high frequency signal, as in figure 4a. You may recognise it as portion of figure 7 from last month.

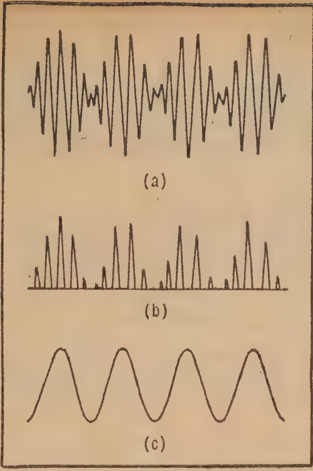

Figure 4: Sketch (a) illustrates the signal present in the tuned circuit of a receiver. Sketch (b) illustrates the action of a detector on the signal and (c) the audio component which is ultimately heard.

(For present purposes we shall ignore frequency modulation, because it is not used on the broadcast band and is not involved in the simple receivers we are at present discussing.)

Despite the fact that the wanted signal has been received and selected it cannot be heard directly, even with the aid of earphones or a loudspeaker. Let's digress for a moment to see how a simple earphone operates. The principles are illustrated in figure 5.

Inside the earphone is a permanent magnet, which may take a variety of shapes. From each pole of the magnet two soft-iron bars, or pole tips, extend forward toward a metal diaphragm.

The diaphragm cannot touch the pole tips because it is held slightly away from them by the way it is mounted. However, it is attracted strongly to the pole tips and in consequence tends to bow slightly inward toward them.

Around each pole tip is a coil of fine wire, the two coils being connected usually in series and phased so that they will supplement each other in their total effect.

When a current is passed through the coils in one direction the magnetic field so created adds to the field from the permanent magnet and the diaphragm is

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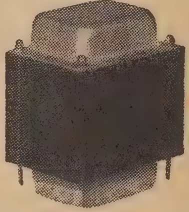

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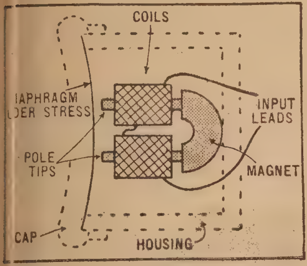
drvn closer to the pole tips. Reversing th current through the coils causes their fie to cancel that from the magnet and te ion on the diaphragm is reduced.

an alternating current is passed th ugh the windings the tendency is for th diaphragm to vibrate to and fro. The m ement is very slight, to be sure, but it enough to set the adjacent air in m ion and if a pair of phones are cl ped to the ears the vibrating air ac ates the eardrums to produce the se ation of sound.

low let's go back to figure 4. If the al rnating high frequency signal (a) from



igure 5: This diagram illustrates the principles of a simple earphone lormally, two earphones are used, one for each ear.

tl tuned circuit is applied directly to the pones no sound will be heard. The ron is not hard to discover:

An upward swing of the current tlough the phones is followed an instant ler by a downward swing. With a radio f quency input signal the alternation is s fast that the diaphragm cannot follow ener, so it merely remains in its initial psition. Nor does the presence of rodulation make any difference, because ech greater or lesser increase in current i followed and cancelled in its effect by a equivalent decrease in current.

Even if the diaphragm could follow tese rapid alternations our ears would rt be able to do so and we would be r better off.

## HE DETECTOR

The impasse is overcome by introcing a very special component called DETECTOR. One form of detector, a diode valve, has already been explained in Chapter 6 of this series. For our present purpose there is a more handy type, known as a CRYSTAL DETECTOR.

This has varied in form from a rather bulky device, seen on the front panel of the set in figure 1, to the modern version, which is about half an inch long and about an eighth of an inch in diameter.

The physics and chemistry behind a crystal detector are very involved, but they add up to a property which resembles that of a diode valve: crystal detectors will pass current in one direction only.

In practice a crystal detector is wired in series with one of the leads connecting the phones to the tuned circuit. This has the immediate effect illustrated in figure 4b. Instead of all the signal being passed through the phones only half the signal gets through. The other half is blocked, because it involves current which wants to go in the direction in which the crystal will not carry it.

Thus, after DETECTION, the signal which reaches the phones has the form illustrated in 4b. It still contains a high frequency component but with a difference: each of the pulses which remain represents stronger or weaker pulses of the one polarity: there are no reverse pulses to cancel them.

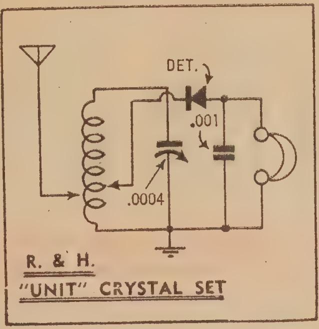


Figure 6: Here is the complete circuit for a crystal receiver. Note the aerial and earth, the tuned circuit, the detector and the phones—all components discussed in the text.

Each brief pulse tends to draw the diaphragm closer to the pole tips or, alternatively, to relieve the tension on it, according to which way around things happen to be connected. The diaphragm will not reproduce any single pulse but the accumulative effect of many successive pulses, all having the same influence, will cause the diaphragm to move.

If the input signal is modulated, as in figure 4b; the accumulative effect of all the tiny impulses likewise varies and the diaphragm tends to follow the average amplitude of the incoming signal. Its movement therefore resembles figures, &c., which is in fact the original sound content of the transmitted signal.

Put the phones on and the oscillations of the diaphragm are heard as sound. The process is complete.

Figure 6 shows the circuit of a complete crystal receiver, illustrating and based on the foregoing discussion. It is the simplest type of receiver. It merely intercepts the incoming signal and makes it audible

**(To be continued)**

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# Miniature Parts Made Bizmac

(Continued from page 7)

This occurrence within the material is mparable to the movement of elecons from the cathode to the anode in e electron tube. Furthermore, as in e transistor, it is possible with the apication of a weak voltage across an ea between the two extremities within e crystal to achieve effects like those oduced by the grid in a vacuum tube These discoveries and their applicaon represent a long step toward iniaturisation on a grand scale. Comessing within a small crystal the basic nctions previously handled by electron bes represents a reduction of perhaps ver 100-fold in space occupied. But. qually important, the amount of power quired to perform these functions ithin a solid is many times less than the total needed to heat a cathode to the "boiling" point in an electron tube

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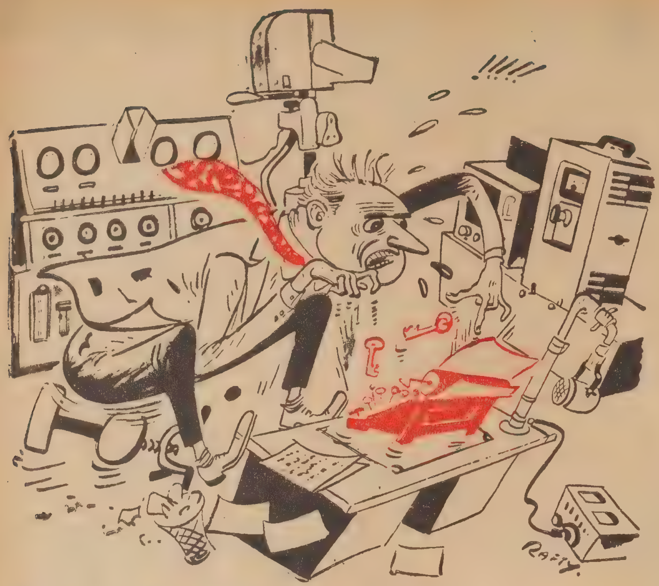

# Let's Buy An Argument

This is a story of how NOT to sell a television receiver. I tell it in the hope it might discourage similar occurences or engender some tolerance and understanding where they do occur.

**by Neville Williams**

THIS story is not a fabrication, nor was it told to me by a third person I saw it happen, personally.

A middle-aged couple had been most impressed by an evening spent around a neighbour's television set. Back at home, that night, they decided to arrange for a demonstration with a view to buying a set for themselves.

This is where I came into the picture. Because I was supposed to know "all about radio," they came seeking advice about the best type of set to buy and the most suitable size of screen.

## NO OPINION

On the first question, I didn't profess to have an opinion, because it would presuppose a knowledge of the circuits and techniques used by the various manufacturers.

This I couldn't claim, nor did I have any first-hand knowledge of the reliability of various brands and models. If you want information on this score, the best people to ask are those selling all brands and models. They soon get to know, by bitter experience, the sets that are awkward or critical or constantly in need of service.

On the matter of screen size, there was opportunity to be more helpful. The viewing room was really only large enough to warrant a 17in screen but, since their eyesight was growing a little hazy with age, I thought they might appreciate the larger picture given by a 21in set.

Why not visit the store of their choice first, while afternoon programs were on and try to satisfy themselves on this important point?

This they did, duly selecting a set for home demonstration which suited their taste and circumstances. It was promised for the following weekend.

Now the store in question belongs to a well-known retail organisation, about whose integrity I have no reservation. True to their word, the set was delivered on the Friday afternoon, with the invitation to keep it for a few days to make sure that it was, in fact, what they wanted.

During Saturday, I got a message to the effect that the set had turned up and "would I like to pop along and h a look at it?"

By the time I arrived, that even they had settled down to watch programs, but, immediately, I could that some of their former enthusia had waned.

"Try it. See what you think of it.

It was on Channel 7 and giving a ture that was literally crawling w "noise." Twiddling the knobs made li difference.

I tried Channel 9, only to find e more noise and less picture.

Channel 2? Just noise, with vaguest suggestion of a picture in background.

## INDOOR AERIAL

The reason was not hard to see, aerial being an indoor gadget perch on top of the cabinet. By fiddling w it, I managed to improve Channels and 9 somewhat but they still were good. Channel 2 remained hopeless.

As a matter of fact, quite apart fro the noise problem, I wasn't happy abo the picture itself. Detail seemed to lacking and the whole effect was a cry from the 17in job you've seen scribed elsewhere in the mag.

Being a little "canny" I hedged a on this aspect and suggested that o really couldn't judge a set with su a poor aerial. Why not ask for a mor effective demonstration?

At this they remembered that the installation mechanic had said that h would rig up a temporary outdoor aeria "if it proved to be necessary."

As far as I could see, there shoul never have been any doubt about it.

The only doubt now, it seemed, wa on the part of the couple concerned — whether television was really worth a that money!

## NEW AERIAL

Early next week, I was told that th outdoor aerial had been put up. Coul I possibly have another look at the set

Such is the role of a friend.

When I walked in that evening, th atmosphere was decidedly frigid.

I rather gathered that Mrs. had upbraided Mr. for not listening to wha the man had said about tuning th receiver. Mr. had reminded Mrs. tha the Instruction Book was there and "sh was perfectly free to try the knobs fo herself!"

Apparently — and this didn't help any — the lady from next door was due in for the evening and the bell would ring at any moment.

I checked the set again. This time

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SENSATIONAL NEW "CISSY" AERIAL—Not just useful on television. Will receive also Hi-Fi VHF broadcasts. "Cissy" is the only possible name for the new aerial—it gets F-M-in-it!

---

it was hard to say which station was the worst; they were all so poor.

After a few moments fiddling, and acting on an inspiration I reached around the back and wiggled the aerial lead. There was a flicker and a flash and the pictures were there, hard and black.

Whoever had "connected" the aerial had done so with the aid of two halves of a broken match. The end of the wires had merely been bared for a half-inch, then jammed into the holes as aforesaid.

### EMERGENCY MEASURE

Since I don't normally carry tip-jacks and a soldering iron in my pocket, I could do no more than bare rather more of the wire, spiral it around the match and push it back in place. But, at least, it would not be so easily dislodged as before.

Reappearance of the picture restored a measure of harmony all around, for which I was duly thankful. I was equally pleased to note that the picture now exhibited the normal amount of detail — something that had been lost before in the confusion of noise and ghost images.

As I write, I gather that the folk concerned intend to buy the set but IN SPITE OF the demonstration, not because of it!

In case you think this to be an isolated instance, let me quote a further story related to me by a member of our staff

A relative of his, living in an outer suburb, had been toying with the idea of buying a television set ever since the stations got under way. He wanted a set all right, but it was just a matter of whether to buy it immediately or make his next time-payment venture to one or other of the things he needed around the home.

Thanks to program publicity and such like, the idea of buying the television has gained ground and as much was mentioned to the local radio dealer.

### SET FOR TRIAL

Next thing he knew, the man in question found the dealer on his doorstep complete with a television receiver and demonstration aerial. The dealer explained that he was in a "tearing hurry" to get away for the long weekend but had a set to spare and our friend might just as well have the benefit of it without obligation, for the next three or four days.

"Just stick up the aerial somewhere," the dealer said, "connect the wires here and it should go.

"You might have to twiddle the knobs a bit but you'll soon find out how they work.

"Got to rush, now. See you later."

Following instructions, the prospective buyer "stuck up the aerial," connected the wires and waited for a picture to appear.

Ten minutes later, he was still valiantly twiddling knobs, getting pictures that jerked and rolled in the most erratic fashion, sometimes black, sometimes misty. Even when he did seem to get things sorted out, the results weren't good.

The man and his wife watched the weekend's programs with difficulty but, by the time the retailer called again, they had fully made up their minds that they could really do without television for a couple of years yet. After all, they did need this and they did need that!

Checking up on the story later, our staff member was staggered to find that the receiver loaned for demonstration had a suspected intermittent fault—otherwise it wouldn't have been available at all. The retailer had loaned it, not with the idea of selling it but simply as a gesture which would lead to a formal demonstration later, when requested.

Unless conditions change drastically the request will be much, much later.

Now I well know that selling television sets is quite a chore. You can't wrap them up like an iron or a toaster and see them carried out the door, never to return. You can't even sell them like mantel radios, more or less on eye appeal in the shop.

Customers insist on a home demonstration and, if they don't like the colour or styling of the first set, they expect another to be brought in its place. If they're going to spend two or three hundred pounds, they're determined to get their money's worth.

### REAL PROBLEM

The retailer has to bear the brunt of this indecision. He has to employ technical men husky enough to carry television sets up stairs and down stairs. He has to provide vehicles which will do justice to his business and protect their costly cargo.

Perhaps we can't blame him for not wanting to be too precise about the demonstration setup, particularly if he knows that a proportion of his prospective "customers" are only using his service to get a free picture show for a few nights.

But can he afford to be other than meticulous? In the cases I've quoted, both couples were genuine customers and sales were either lost or nearly lost by sheer carelessness.

It's not just enough to explain to customers that reception will be a lot better when the set is properly installed, when they've paid up for an efficient aerial. Some of the customers will believe the story, the others merely use it as an excuse for not making up their mind.

### BETTER PRACTICE?

In the long run, it may be better business to give fewer but thorough demonstrations, with a high percentage of completed sales, than to follow the reverse procedure. I know of one firm which is currently adopting the policy of not giving demonstrations unless the customer accepts the principle of having an adequate aerial erected temporarily for demonstration, to be made permanent if the deal is closed.

Their view is that such a policy discourages "customers" who are merely after the free show. It minimises the risk of dissatisfaction with the preferred receiver and therefore the inclination to swap it for another brand. And, last but not least, it minimises the complaints and ill-will which can easily arise from weak signals and ghost troubles due to inadequate indoor aerials.

Does all this cancel what I had to say recently about the use of unduly elaborate aerials?

Not a bit of it.

There's no more sense in buying and installing a fringe-type aerial close to the station than there is in expecting a receiver to give its best with a ghost-ridden signal, way down in the noise.

Still on the subject of television, the remarks some issues back about television advertising, were apparently appreciated by technical readers at least. I can't

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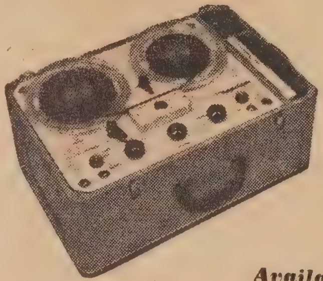

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# RULES FOR VIEWING TELEVISION

*The following rules for comfortable television viewing have been originated by the British Institute of Ophthalmology. Do you agree or disagree?*

- Sit at the right distance from the screen.—Not less than 6 feet and up to 15 feet for a 17-inch screen, and not less than 10 feet and up to 20 feet for a 21-inch screen. Suit the size of the screen to the size of your room.
- Have your set at the right height. Sit in a comfortable chair, in which you can relax, so that the screen centre is about eye-level.
- Do not sit too far to the side—not more than 40 degrees from the centre line.
- Place the set so that reflections of windows, artificial lights or the fire do not appear on the screen.
- Avoid glare, but do not view in total darkness. The contrast between the bright screen and a dark background leads to a glare condition.
- Keep your set properly tuned and maintained. Unsteady or ill-defined pictures tire the eyes.

claim, however, that the fanciful phrases have been dropped from adverts. as a result.

On the contrary, a few more "gems" have found their way into the said television adverts.

Most lustrous of them all and the one to which I must award the prize, was the ad which stated that a certain new model T.V. receiver had a frequency modulated sound channel. It wasn't claimed as an exclusive feature, to be sure, but it was described in such glowing terms that the uninitiated must surely have assumed that this was something really new, almost exclusive.

If ever I find myself selling Holdens to the natives of New Guinea, I must remember to make great capital of the fact that they have four wheels!

That will really slay the competitors.

So much for that.

## MORE T.V.!

Although I made a valiant effort to get away from television last month, in these columns, it is difficult to do so.

It must be very frustrating for readers in other States to have to view all these activities from afar. Let's hope, from a technical standpoint, anyway, that it won't be too long before the allotted channels are vibrant with life in other centres of population.

From a reader in Coburg, Victoria, comes a letter disagreeing with the oft-repeated advice to view television in subdued light rather than in complete darkness. He says:

> *Many people, opticians, doctors, T.V. set salesmen and, I suppose, some members of the staff of RT & H believe that T.V. sets should have filter glasses and/or should be viewed in conditions of medium ambient lighting.*
>
> *I do not.*
>
> *I believe that most of these types of people have been led astray by others more interested in pandering to an ignorant public than to the ocular health of the said public.*
>
> *To have medium ambient lighting shining into the eyes causes eyestrain.*
>
> *To have objects in the room illuminated causes mental distraction and thus strain.*
>
> *TV should be viewed in complete darkness.*
>
> *'It is better to have some inconvenience when passing from a darkened room to a lighted room than to sit for hour after hour in bad conditions.*
>
> *The inconvenience could be lessened by using sun glasses while the eyes are adapting themselves to the lighted room."*
>
> *Yours faithfully, M.G.*

Thanks M.G., for your letter. I like your style, brief and to the point.

I like the way you assert your views. It's good for argument.

## BUT WHY?

What has me puzzled is the reason for the said views. Are they the outcome of reasonable viewing experience? Do you speak as one having more than a passing knowledge of the human eye? Have you a "chip on your shoulder?" Are you trying to start a witch-hunt?

Whatever the explanation, I might as well say straight out that I don't agree with your contentions, nor do I follow them in practice. I just like to watch television (when I can find the time) under medium light conditions.

The thought of stumbling around in a blacked-out room or screaming at someone who opens a door or strikes a match, leaves me completely cold.

And as for sun glasses . . . well!

M.G.'s bracketing together of ambient light conditions and the provision of filter-type safety screens is valid, if not immediately obvious.

Picture tubes have a glass face backed by a whitish phosphor, backed again in most cases by a microscopically thin layer of aluminium. They act, therefore, as tolerable reflectors of incident light.

With no image on the screen, the face of a television tube therefore assumes a mid-grey tone in a partly-lit room. Presented under such conditions, a picture cannot exploit the full range of tones from black to white but is confined to the range mid-grey to white.

### ANOTHER UNSOLVED MYSTERY!

*Remember the riddle of the post-synch. pulses? Who can forget it?*

*Well here's another one.*

*A few months ago, a newspaper story from England told how certain experimental television transmissions caused a large proportion of the viewing audience to observe an overall tint in the reproduced picture. Interviews with typical viewers were quoted. Some saw one tint, some another.*

*Some saw nothing unusual.*

*We've waited in vain, since, for an explanation of what it was all about.*

*Was it some scheme which a "back-room boy" had thought up in an effort to overhaul American leadership in colour TV?*

*Had 70 per cent of the viewers been tippling that evening to the point where they could be made to see anything?*

*Was the whole thing a hoax and, if so, on whose part?*

*Was it an attempt to start a new legend as a mate for the Loch Ness monster?*

The reason is obvious enough. While an electron beam can activate the screen to produce highlights, the "black" areas are produced simply by cutting off the beam current. There is no way, electronically, of making sections of the screen darker than they really are.

If one can interpolate a thought here, this statement may well be contested on the grounds that it doesn't seem to work that way in practice. The blacks in a picture usually look a lot darker than what one would expect from a preliminary inspection of the screen. How come?

You can thank your eyes for this effect. In a partly lit room, the eyes automatically set themselves to a "wide aperture," to use a photographic term, in order to collect as much light information as they can. Under these conditions the screen looks a definite mid grey.

The moment you turn on the picture and look at it, your eyes reduce aperture to cope with the extra light and the effect of the ambient light on the screen diminishes in proportion. The "blacks," therefore, appear a lot darker than you might have imagined possible.

Another important point relates to the colour of the ambient light. Most television pictures tend to the blue end of the spectrum. It is surprising how much ambient light you can "see through" if that light comes from incandescent globes in traditional "autumn tone" light shades, favouring the red end.

## FULL LIGHTING

Where you just want a picture, without worrying about the finer points, it is entirely possible to watch it against full overhead room illumination under these conditions.

The idea of tilting the safety glass and picture face slightly forward at the top is also helpful, because it reduces the amount of incident light from overhead and minimises risk of reflection from other lights at intermediate levels.

But the use of light-absorbent safety glass is the best known aid to viewing in moderately lit rooms. It does not reduce the brightness of the picture, as far as the viewer is concerned, because he compensates by turning up the brightness control by the appropriate amount.

**(Continued on page 121)**

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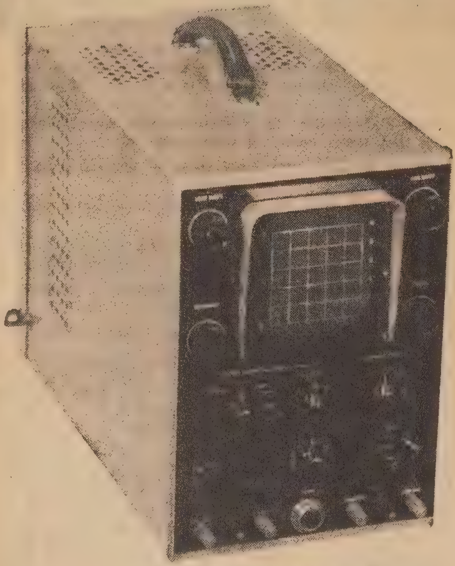

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# TESTING WITH SQUARE WAVES

Square-wave testing is a technique which is being widely used to-day for wide-band amplifiers including video amplifiers. Used with a good oscilloscope the square wave generator provides much information speedily and conveniently

### By E. G. LOUIS

BY means of a Fourier analysis it is possible to show that an "ideal" uare wave, Fig. 1 (Curve 1) consists of fundamental (Curve 2) sine wave hose frequency is equal to that of the juare wave, together with the third urve 3), fifth, seventh, ninth and higher dd harmonics, the amplitude of each ecreasing in direct proportion to its rder. Theoretically, a perfect square ave consists of a fundamental together ith an infinite number of higher odd armonic signals.

If such a square-wave signal is applied the input of an electrical circuit, hether a filter network, amplifier, or ther system, and the system does not espond equally well to the fundamental nd all higher harmonics, then the output ignal obtained will be distorted in a ashion indicative of the response char cteristics of the system under test. This s the basis of the square-wave test tech ique.

## RAPID METHOD

Since not only the fundamental but all higher harmonics are applied simultaneously, and an indication of the system's response to this wide range of signals is obtained at once, square-wave testing provides an extremely rapid method for checking such network characteristics as frequency response, phase shift, transient response, etc.

Because of the speed with which the square-wave test technique can be applied and information obtained, this method becomes quite valuable not only as an aid in the production testing and servicing of electronic equipment, but can be applied with equal, if not greater value to the requirements of the practical design engineer.

In the past the technique of square wave testing has been confined largely to testing high-fidelity audio amplifiers and wide-band amplifiers with a bandwidth of perhaps several hundred kilocycles or one megacycle.

## VIDEO USE

With wide-band oscilloscopes now commercially available at prices within the reach of even the moderate-sized experimental laboratory, and with square wave generators on the market delivering square waves with fast rise times to frequencies as high as one megacycle, this valuable and easily applied technique can be applied to a very much greater extent.

It may be used for checking not only audio amplifiers, transformers, and similar systems but also for the check and design of wide-band scope and radar amplifiers, video amplifiers and similar wide-frequency-range networks.

Since the techniques of square-wave testing and analysis can be applied in the same fashion irrespective of the end results in view, whether servicing, design or production test, we will try to simply outline the basic technique, with the major emphasis on the application of the technique in the design and service of wide-band amplifier circuits.

Fundamentally speaking, only two pieces of equipment are required to apply the square-wave test technique, a square-wave generator and an oscilloscope.

## THE EQUIPMENT

The square-wave generator may consist of a sine-wave generator and a suitable clipper amplifier where audio circuits and comparatively narrow band circuits are to be checked. Where the response of video amplifiers and similar wide-frequency-range systems are to be checked, however, it is best to obtain a specially designed square-wave generator.

In general, the square-wave generator should deliver perfect square waves with a short rise time at frequencies from the lowest frequency response of the system to be studied to a frequency one-tenth the highest frequency response of the system.

For practical laboratory work a square-wave generator delivering signals from 50 cps to about 500 kc or one mc with a rise time of at most .1 microsecond (and preferably less) will be found suitable. These signals may be available over a continuously variable range, or only at four or five "spot" values within this range. The output voltage should be easily varied from under one volt to at least eight to 10 volts. Output impedance should be low. 600 ohms is about the highest that can generally be tolerated, particularly at high frequencies.

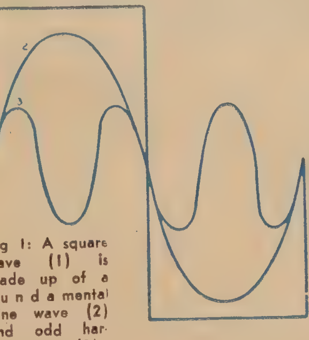

Fig 1: A square wave (1) is made up of a fundamental sine wave (2) and odd harmonics (3)

The oscilloscope used must have characteristics that are superior to the system under test. From a general viewpoint its vertical amplifier should be flat below the lowest frequency square wave to be used in testing to a frequency 10 times higher than the highest frequency signal to be used (within one or two db).

## CRO SPECIFICATIONS

It should not, in itself, cause any appreciable tilt or overshoot to any square-wave signal applied to its input within the range to be used for test purposes. The vertical amplifier should have a sensitivity of at least .5 volt/inch (peak-to-peak) and preferably more.

A linear time base should be available within the scope which permits observation (with expanded sweep if necessary) of one cycle of both the highest and lowest frequency square waves to be used in testing.

The basic setup used for square-wave testing is illustrated in block diagram form in Fig. 2. A square-wave signal is applied to the input of the system to be tested and the input and output signals observed on a cathode-ray oscilloscope. Deviations from the original square-wave shape indicate certain characteristics of the system under test.

Test leads, both to and from the equipment, should be as short as possible, otherwise, with high-frequency signals, or signals with a short rise time, unnatural peaking and overshoot may be introduced due to resonance in the connecting leads themselves.

The output signal should be observed at a point where the loading of the CRO will not appreciably affect the circuit parameters. If a high-impedance, low-capacity probe is used with the scope, then individual stage characteristics can be observed.

## LIMITATIONS

Since a square wave contains only a fundamental and higher harmonics, it is not ordinarily employed for checking the response of a system at frequencies lower than its fundamental value. The exception to this is the case of a network whose response is such that the fundamental of the square wave is changed in some manner with respect to its higher frequency components. Such a condition may cause a change in the square-wave shape indicative of the system's response at lower frequencies.

Only odd harmonics of the square wave are present as part of the entire signal hence any sharp dips or holes in the response characteristics of the system at specific frequencies falling between the odd harmonics may not show up in a square-wave test. However, the response of most amplifiers varies in a smooth manner and this limitation is minor.

In general, a square-wave test will not indicate distortion due to overload or

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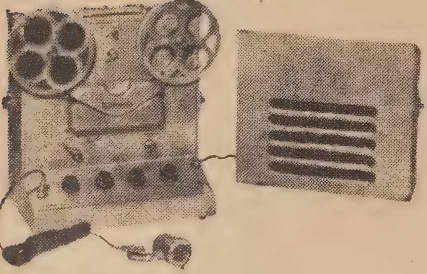

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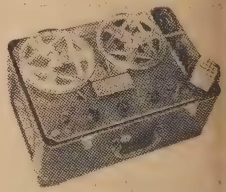

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verdrive on an amplifier, unless the verload distortion varies with frequency he square wave is simply made more square." and a sine-wave signal still ust be used for such tests.

Finally, since it is almost physically npossible to produce a "perfect" square vave, and very difficult to detect hanges in the square wave because of eterioration of signals higher than the enth harmonic, square-wave signals hould be available and used at approximately decade values. The exact number of signals required for a complete est will depend on the band-width of he system under test.

## USEFUL FREQUENCIES

From a practical viewpoint, signals of 50 cps. and 1 kc. are suitable for testing usual amplifiers and transformers For checking wide-band amplifiers generally used in the lab., frequencies of 50 cps., 1 kc., 10 kc., and 100 kc. may be used. For checking video amplifiers, signals of 50 cps., 1 kc., 10 kc. and 100 kc. may be used. Signals as high as 1 mc. may be used for checking special pulsing circuits.

Typical patterns that may be obtained when a low-frequency square wave is applied to an amplifier or network are shown in Fig. 4 A basic triode, resistance-coupled amplifier stage is shown in Fig. 3.

If the amplifier responds perfectly to the input square-wave signal, neither attenuating nor accentuating the higher harmonics and causing no phase shift, a perfect output square wave will be obtained which, except for amplitude, is identical with the input signal as shown in Fig. 4A.

A boost at the fundamental frequency of the square wave with respect to its higher harmonics, but with no phase shift, will result in the rounded signal shown in Fig. 4B. Conversely, a loss at the fundamental frequency will result in a general dip in the square wave as shown in Fig. 4C, while a dip in the response curve, causing a loss of a particular harmonic, will result in a dip at one or more points in the square wave as shown in Fig. 4D.

## PHASE SHIFT

Leading phase shift at low frequencies, but without appreciable signal loss, displaces the fundamental with respect to the harmonics, resulting in a tilted square top as shown in Fig. 4E. This is generally due to too low time constant in the RC coupling network (Cgl-Rg in Fig. 3). If a loss of signal accompanies the phase shift, then the flat top will curve downward as well as be slanted, as shown in Fig. 4F. An extreme case of too low a time constant in the coupling network may cause differentiation of the signal, allowing only the higher harmonics to pass and resulting in a peaked signal as shown in Fig. 4G. Such a signal may also be obtained due to high-frequency leakage around an attenuator circuit.

Where low-frequency compensation is added to the amplifier stage (Rc-Cc in Fig. 3) over-compensation may result in the phase lagging at low frequencies, causing the square wave to tilt in the opposite direction as shown in Fig. 4H.

Irrespective of whether leading or lagging phase shift causes the square wave flat top to tilt (Figs. 4E or 4H), the amount of the tilt depends on the degree of phase shift. A 10 per cent. slope will

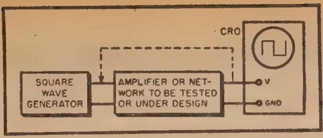

Fig 2 Setup for square-wave tests

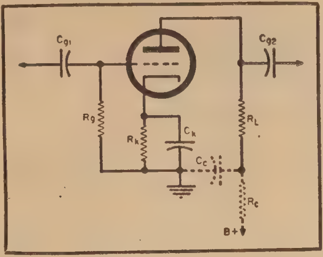

Fig 3 Basic triode amplifier circuit

be obtained when the phase shift is two degrees at the fundamental frequency of the signal.

From a design viewpoint, conditions shown in Figs. 4E, 4F or 4G generally indicate (in Fig. 3) either that Cgl or Rg or both, should be increased in value that Ck should be made larger, or that insufficient low-frequency compensation has been added. This, in turn, means that either Cc should be made smaller or Rc should be made larger (with respect to Rl). If the condition shown in Fig 4H is obtained, then the amount of low-frequency compensation should be lowered, by either reducing the value of Rc or increasing the value of Cc.

## TILT PATTERN

From a servicing viewpoint, conditions indicated in Figs. 4E, 4F, or 4G generally indicate (again in Fig. 3) either that Cgl or Rg has become lower in value (usually Cgl will have partially opened—fully open would result in Fig. 4G; that Ck has lost capacity, that Cc has increased in capacity (unlikely) or that Rc has dropped in value (which may happen due to overload). The condition of Fig. 4H indicates, generally, that Cc has lost capacity or developed high power factor. It may also indicate that Rc has increased in value, but this is not very likely.

The response of the amplifier to both low and high frequency signals must be considered before a full analysis of circuit operation can be made. Both tests when taken together, give a much better picture of conditions in the system under test.

Circuit deficiencies at high frequencies may result in any of the patterns shown in Fig. 5 (and even in some of those shown previously, particularly as far as phase shift is concerned). A typical single-stage RC-coupled triode amplifier is shown in Fig. 7, together with some of the factors affecting its response to high frequencies.

## HIGH FREQUENCIES

As in Fig. 4A, the "perfect" signal is shown in Fig. 5A. A loss of higher frequency harmonic signals will result in a rounding of the leading edge of the square wave as in Fig. 5B. The degree of rounding is dependent on loss of high frequencies, and an extreme loss will result in the output square wave approaching a sine wave in form. If almost all higher harmonics are lost the square wave may appear as in Fig. 5C.

Resonant circuits in the amplifier (or in the connecting leads) may cause "ringing" and result in damped oscillations on the leading edge of the square wave, as shown in Fig. 5D. The frequency at which the oscillations occur can be determined approximately by multiplying the number of "cycles" that would be present along the flat square top of the signal (if not damped) by twice the fundamental frequency of the square wave. Where rapid damping occurs, or where the resonant frequency is extremely high, only a small "overshoot," as shown in Fig. 5E, may be obtained.

## RISE TIME

Since the rise time (time for square wave to go from 10 per cent. to 90 per cent. of its peak value) is dependent on the number of higher harmonic signals present without attenuation, this serves as a good indication of uniform frequency response of an amplifier or network, irrespective of whether rounding of the square wave occurs or not.

An increase in rise time in a square wave is shown in Fig. 6.

A simple relationship, accurate enough for most practical design work, between rise time and uniform frequency response of an amplifier, is as follows:

Maximum f (uniform response in mc.) equals

$$\frac{1}{2T_r}$$

where Tr is the rise time in microseconds. (This relation holds true only where artificial means such

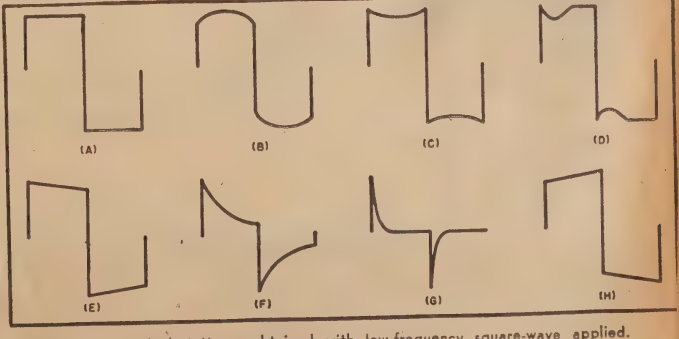

Fig. 4: Typical patterns obtained with low-frequency square-wave applied.

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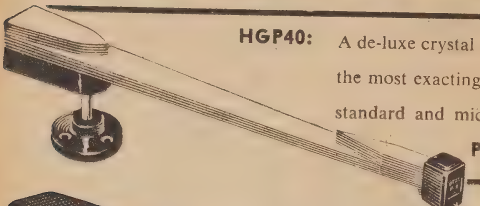

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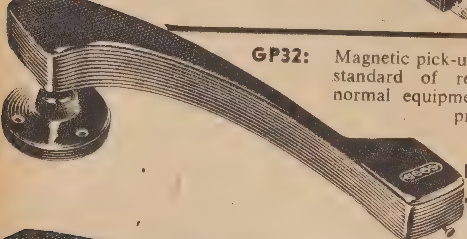
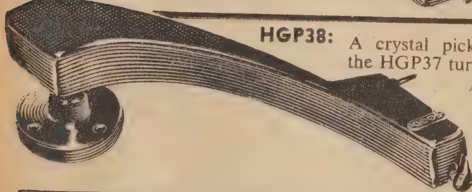


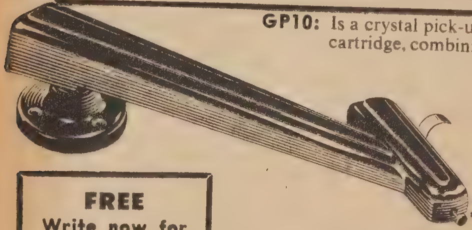
**GP32:** Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage, ½ volt at 1,000 c.p.s.
**PRICE, £2/12/6**



**HGP38:** A crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus.
**PRICE, £5/15/-**

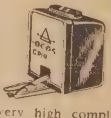
**GP50:** Is a HIGH-OUTPUT crystal pick-up suitable for reproducing standard and microgroove records through *low-gain* amplifiers as used in small record players and some radios
**PRICE, £4/19/6**

**GP60:** Incorporates the latest-type CERAMIC cartridge—unaffected by heat or humidity. For use in tropical areas. **PRICE, £6/16/-**



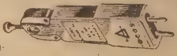
**GP10:** Is a crystal pick-up utilising the GP9 cartridge, combining purity of reproduction with extreme reliability. Resonance-free response from 50/8,000 c.p.s. Output, 1.5V at 1,000 c.p.s.
**PRICE, £3/12/6**

## plus these acos replacement cartridges



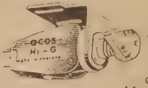
**HGP39 CARTRIDGE**

Designed to meet the most exacting requirements of modern recordings — low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available. **PRICE, £3/12/6**



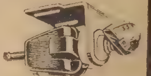
**GP9 CARTRIDGE**

Now famous as the cartridge with the unbreakable crystal. Takes standard steel or fibre needles for 78 r.p.m. records.
**PRICE, £1/11/6**



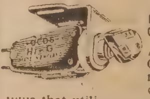
**GP59 CARTRIDGE**

A HIGH-OUTPUT cartridge suitable for reproducing standard and microgroove records through low-gain amplifiers.
**PRICE, £2/3/-.**



**CARTRIDGE GP61**

A CERAMIC cartridge that will withstand the rigours of a tropical climate and is, at the same time, very robust. **PRICE, £3/19/6**



**HGP37 CARTRIDGE**

A TURNOVER cartridge with cantilever stylus that utilises a new method of crystal drive, a bisectional control element that achieves independent characteristics for standard and microgroove. **PRICE, £2/18/6**

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eaking coils, are not used to shorten rise time.)

rom a design viewpoint, conditions wn in Figs. 5B or 5C indicate that high-frequency response of an ampli- is not sufficient. This can be im- ved by reducing the effect of dis- uted capacities shown in Fig. 7 by ing Rl as small as is practicable the gain desired, and then by using es and shunt peaking coils. as shown Fig. 8, to offset these capacities.

o obtain reasonable gain with a low it may be necessary to go to tubes ing high mutual conductance. In h a case. the stage gain is equal to the duct of the load resistance and tube tual conductance.

istributed capacities are reduced by ping leads short, parts and leads ve the chassis, and using miniature ts where economically feasible.

## AKING COILS

The inductance of the peaking coils generally chosen so that resonance l occur with the distributed capacities the circuit at frequencies higher than highest frequency at which uniform ponse is desired in the amplifier. In tter amplifiers, these coils are usually de adjustable so that each unit may adjusted for best response for the in- vidual distributed capacities in that it.

If these coils resonate at too low a equency, or if insufficient damping 81 and R82 in Fig. 8) is used, a vere overshoot may occur, or an oscil- tory wave train may be set up, as own in Fig. 5D.

Often a slight amount of overshoot bout 5% maximum) is desirable, as tends to shorten the rise time of the mplifier. Thus, the condition shown Fig. 5E would not always be consid- red objectionable.

## UNDRY PATTERNS

A loss of higher frequency signals ay occur if there is inductance in the lectrolytic capacitor used for cathode ypass (Lck in Fig. 7), due to degenera ion across Rk and the loss of gain at hese frequencies. In practical design, his can be offset by bypassing the lectrolytic with a small capacitor around 005 mfd.), at Ck1 in Fig. 8

From a servicing viewpoint, condi- ions illustrated in Figs. 5B and 5C may indicate that a peaking coil has become shorted or open (if shunted with a damping resistor) or that Rl has increased in value. In some cases it may indicate an open in Ck1 (Fig. 8).

The condition shown in Fig. 5D may seldom be encountered, but generally indicates that a damping resistor across a peaking coil has opened.

The condition of Fig. 5B, at higher frequencies, together with the condition shown in Fig. 4H at lower frequencies, would indicate that Cc (Fig. 3) has become open or dropped in capacity. Thus, it is practical to use a combination of conditions to indicate a specific defect.

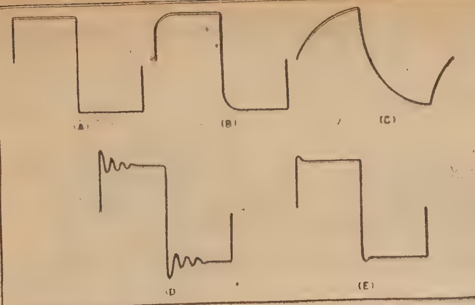

Fig. 5: Square-wave patterns that may result from circuit deficiencies at the high frequencies with a good square-wave input

Square waves, observed with a cathode-ray oscilloscope, provide an efficient and extremely rapid technique for testing and servicing systems designed to pass a band of frequencies. The technique can also be used to good advantage in design and production engineering, for adjusting circuits for proper operation, and for determining optimum values of components.

## OVERALL RESPONSE

The basic relationship between the frequency response of an amplifier or network and its effect on square waves can be obtained by referring to Fig. 9.

A simple resistance-coupled amplifier may have the response shown in Curve 1. With this type of response curve a low-frequency square wave will appear as in Fig. 4E; at middle-range frequencies as at Figs. 4A or 5A; while a high-frequency square wave will appear as at Fig. 5B.

If low-frequency compensation is added, resulting in a boost at low frequencies as shown in Curve 2, middle range and high-frequency square waves will appear as previously, but low-frequency square waves will generally be tilted in the opposite direction, as shown in Fig. 4H. With the proper amount of compensation a perfectly flat-top low-frequency square wave may be obtained, but this is frequently difficult to maintain in production unless each unit is adjusted individually.

## HIGH BOOST

When a peaking coil is used to provide a boost at high frequencies the overall response may appear as shown in Curves 3 or 4, depending on the frequency of peaking and the amount of damping. With a response as shown in Curve 3 a high-frequency square wave may appear as in Fig. 5E, while middle and lower-frequency square waves will remain as previously. If the response is as in Curve 4 a high-frequency square wave will appear as in Fig. 5D, and a middle-range frequency square wave as in Fig. 5E.

If high-frequency compensation is obtained by reducing distributed capacities a high-frequency square wave can be made to approach the input signal in form, as in Fig. 5A, and the response curve becomes as shown in Curve 5. Note that the response falls off smoothly at higher frequencies.

The same result can be obtained by reducing Rl, but this results in reduced overall gain.

—By Special Arrangement, Radio and Television News.

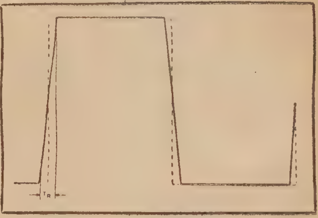

Fig. 6. Illustrating rise time measurement on a square-wave form.

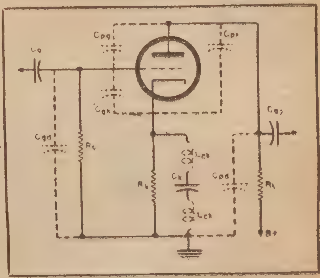

Fig. 7: Distributed capacities and inductances in basic amplifier circuit

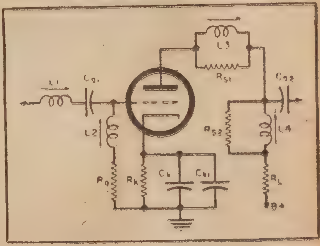

Fig. 8: Series and shunt peaking coils compensate for high-frequency losses.

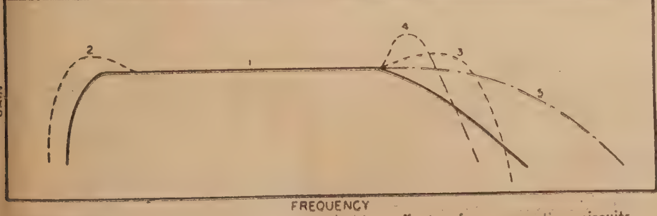

Fig. 9: Basic amplifier response curves showing effects of compensating circuits.

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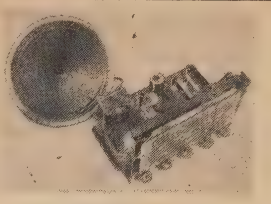

## RADIOGRAM CHASSIS

These radiogram chassis were specially designed for high quality reproduction of records and radio programs. A special inverse feed-back circuit is employed and latest types of valves are used, tone and automatic volume controls are incorporated.

The dial is made of perspex and all local stations for each capital city are in large letters and country stations in small. Dial Colours are Gold, Maroon, Black and Yellow Price. 5-valve dual-wave.

**£14/19/6**

## RECORD PLAYER AMPLIFIER

Very compact and light weight. This unit combines a 4½ watt amplifier with two inputs, one for the built-in 3 speed Philips record player and one for a crystal microphone, each input has its own volume control. Also two outputs, one connected to the built-in speaker and one for a separate extension speaker. An on-off switch and tone control is provided. The cabinet is finished in two-toned leatherette Ideal for parties or for playing records in the home. Well worth 35 gns.

**Price only 27 gns.**

6in extension speaker in leatherette covered box. Worth £3/4/ **Our price 49/6**

Crystal microphone to match this unit. **45/-**

## IFF SET TYPE B.C. 966

Brand new with 3-7193, 7-6SH7 and 3-6H6 valves, an 18 volt to 450 volt at 50mA genemotor and blower, carbon pile regulator, 3 multi contact relays and dozens of resistors and condensers of all types.

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## CHIEFTAIN MULTIMETER

An ideal pocket-sized meter in a plastic case, overal size 5½ x 3¾ x 2¼in. The meter has 100 ohms per volt sensitivity. Voltage readings are 0-15, 0-150, 0-300, 0-600, and ohms scale reads, 0-100,000 ohms. This multimeter is ideal for the hobbyist, motor mechanic, radio serviceman and electrician

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3 **Germanium Diodes.** Ideal for crystal sets, meter rectifiers and radio set detectors. Brand new English make **Only 5/6 each.**

4. **0-5mA meters** with 2in scale and square face **Price only 22/6 each.**

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6. **Vibrator Transformers.** 6 volt to 135 volt. Ideal for Vibrator receivers using 1.5 or 2-volt valves. Worth 19/6 **Our price 14/6 each.**

7. English make **Magnetic Pickups** with bakelite arm for 78 r.p.m records only **10/ each.**

8. **3-inch Extension Speakers,** brand new, in bakelite case, all colours, a very good line. Sacrificed for **22/6 ea**

9. **6½-inch Speakers.** Permanent magnet type with 10,000 ohms transformer Brand new and boxed These will replace speaker in most AC or battery sets. Worth £2/10/ **Our price only 25/ each.**

10. **4-valve Vibrator Mantle Sets.** ideal for caravans, etc. These sets operate from a 6-volt battery, they are new and guaranteed in working or Worth 29 gns **Our price £12/10 less battery.**

11. **0-150mA Weston Meter,** 2-inch scale, round face. Brand new and boxed, few only. **Price only 22/6 ea**

12. **Radio Receivers type BC-357J.** Made for U.S. Army. This is a 2-valve set operating on high frequency using 1—12C8 and 1—12SQ7 valve and incorporating an extremely sensitive SP relay, resistance of which is 12,500 ohms. These sets are brand new with valves, **only £2/10/ each.**

13. **650 ohm, 20 watt WW Resistors** with variable tap **Price only 2/9 ea.**

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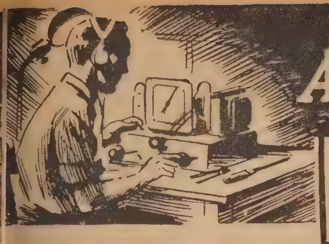


# A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

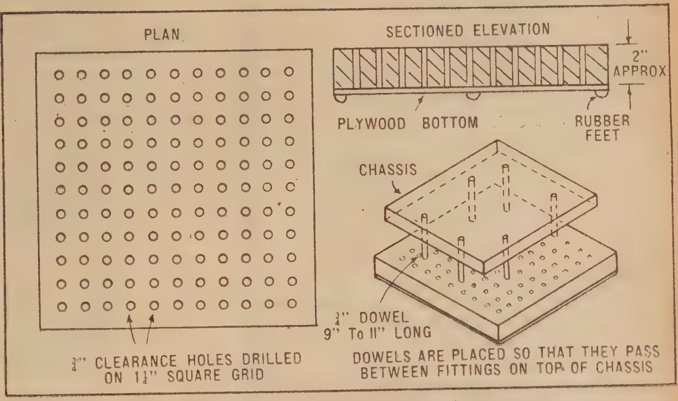
## SIMPLE CHASSIS SUPPORT TAKES ANY RADIO RECEIVER

**A serious practical difficulty when servicing many receivers is in supporting the chassis in such a way that no damage is done to above chassis parts such as valves, dial mechanism, coils and speaker.**

OUR correspondent, Mr. Maxwell C. Geikie, of Coburg, Victoria, offers suggestion which should cost prac-cally nothing in terms of either time r money to construct. At the same me it should be capable of doing an xcellent job of supporting some of ie awkward chassis manufacturers ometimes find it necessary to turn out n order to fit in with special cabinet esigns.

The chassis is supported by dowels vhich pass up between components. 'he dowels may be placed in any one f a number of holes so that chassis omponents can be cleared.

Mr. Geikie suggests that ¾in dowel e used and made from 9in to 11in ong. The number of dowels you need vill depend on the work you have in nind but you are unlikely to need nore than four for any one job.


PLAN
¾" CLEARANCE HOLES DRILLED ON 1½" SQUARE GRID
SECTIONED ELEVATION
2" APPROX
PLYWOOD BOTTOM
RUBBER FEET
CHASSIS
¾" DOWEL 9" To 11" LONG
DOWELS ARE PLACED SO THAT THEY PASS BETWEEN FITTINGS ON TOP OF CHASSIS

The main body of the chassis support can be made from 2in thick material, either plywood or solid being suitable. Holes for the dowels can be drilled in a regular pattern as suggested in the drawing, separated by a distance of 1¼ inches.

The dowels are prevented from going right through the baseboard by a piece of 3/16in ply or presswood screwed, nailed or glued to the underneath. Some rubber feet o. pieces of felt complete a useful project.

## ADDITIONAL CIRCUITS FOR CLOCK RADIO

MR. A. P. CAHILL, of Malvern, explains his idea in detail and we can do no better than to quote directly from his letter. "The idea is to overcome one fault (I think), which exists in clock radios, namely that if the volume is low enough to lull you to sleep then how is it going to wake you up in the morning?

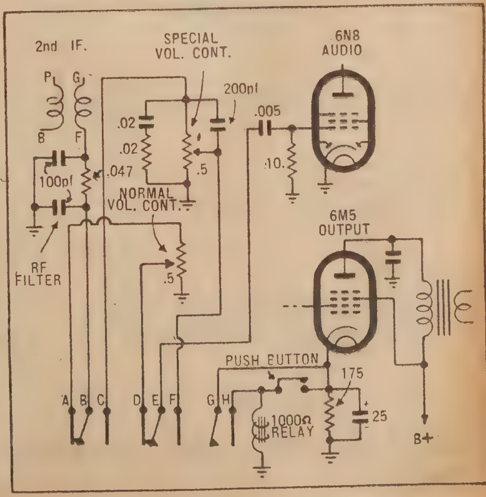
"The circuit (which is adapted to the clock radio in the November, 1955, issue) works as follows: A 1000 ohm, or thereabouts, relay with two sets of single pole, two position, and one other set of contacts. The latter are to be closed when the relay is energised. The relay is wired (see circuit) so that when it is not energised, the normal volume control of the set operates.

"However, when a push-button is depressed, the relay is energised and the preset volume control is wired into circuit. Contacts A-B-C, D-E-F achieve this while contacts G-H lock the relay in position. As the relay draws its power from the output valve cathode bias, the relay cannot be opened until the set is switched off.

"When you want to go to sleep to soft music, you merely press a button, the volume drops to a soft (predetermined) level. The set then switches itself off after the period you have selected on the clock controls.

"When the clock switches the set off, the relay opens, and the volume level returns to that of the normal volume control setting, so that when you awaken in the morning, it is to the sound of loud commercials.

"The purpose of the network across the special volume control is to compensate for the bass sensitivity of our ears at low levels. This is achieved by the 0.02 uF capacitor and the 0.02 megohm resistor. The 200 pF capacitor gives a slight treble boost. While this network would cause severe distortion on account of the AC shunting normally, its effect may be discounted as the circuit is only used at low levels. For the same reason the effect of the inductance of the relay may be neglected also."



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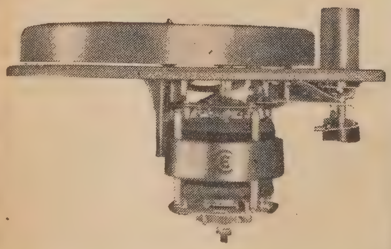

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| TYPE 12B/1 | (Shaded pole motor) | £29/15/6 |

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# TRADE REVIEWS AND RELEASES

## Philips Automatic Record Player

The Philips record player-changer type AG2205/AG-2005 features a new type pickup of high performance, record changing facilities for 45 r.p.m. discs, and three speeds. Of the plug-in pickup heads, the LP version has a diamond point and the 78 version a sapphire as normally supplied.

The appearance and general finish of the new Philips automatic record player is such as to be in keeping with high quality radiogram units.

AN automatic arm positioning movement is provided for 7in, 10in and 12in diameter recordings, but non-standard discs can be played if required. peeds available are 33 1/3, 45 and 78 p.m. There is a fine speed adjustment n all three speeds.

A particularly neat built-in stroboscope enables the speed of the turntable o be checked against the mains where he pitch is required to correspond xactly with that originally recorded. A mall window is the only external vidence of this facility.

### FULLY AUTOMATIC

With 7in records having a large centre hole (normally 45 r.p.m.) the unit operates as a fully automatic changer. A special large diameter spindle containing the changer mechanism is supplied and the unit will handle eight to 10 records at the one loading, the exact number depending on their thickness.

Interchangeable pickup heads are available to suit either the standard or the microgroove type records with the choice of either diamond or sapphire stylus. The unit can be used with the standard Philips crystal pickup heads and provision has been made for altering stylus pressure for heads of different weight by means of a spring lever built into the base of the arm.

### MAGNET DEVICE

Design of the magnetic pickup head normally used with the player is completely new. A drawing and description appeared on page 103 of the July issue. It is a moving magnet device, the magnet being made from lightweight, high coercive material Ferroxdure. Electrical pickup is from the fixed coils of the magnetic system, and output is sufficient for most amplifiers without the use of a transformer.

The effective mass of the stylus tip is 3 mgm; the lateral compliance very high. Frequency response is flat between 30 c/s and 15 Kc/s with the resonance above the upper limit.

**Operation of the unit is simple.**

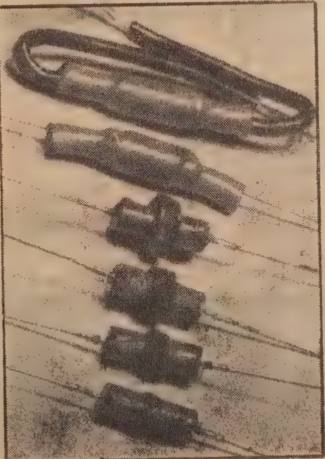
A set of three control buttons is provided. The left button is for automatic operation of the arm when playing single records and according to the amount by which it is pressed the arm will come into position for 7in, 10in or 12in records. The centre knob is marked "Stop" and the right knob "Start." By appropriate manipulation of these as set out in the operating instructions with the unit, all situations can be handled.

On test the pickup, which needs no coupling transformer, gave clean, crisp reproduction with very good bass.

Its compliance makes tracking easy, and in all respects it performs in the highest class. Motor rumble was low, and mechanically the changer operated perfectly.

## TELEVISION CHOKES FROM RCS RADIO

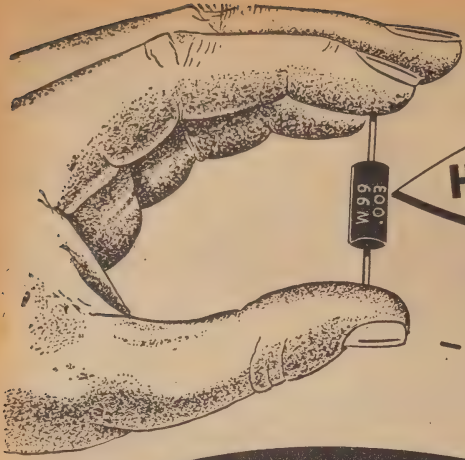
FROM RCS Radio Pty. Ltd. come the first of a new range of peaking chokes. Later the chokes will be available in the full preferred series of inductances but the first samples are to suit the "Radio, Television and Hobbies" 17in television receiver having inductances of 15 uH, 47 uH, 150 uH and 330 uH. Inductance values are coloured coded. A fifth choke of small inductance is intended for use in the filament circuit of the receiver. It is wound with heavier wire and provided with a PVC sleeving.



The chokes are wound on a core of ferrous material, the connecting wires being moulded into the body. The terminating wires will support a weight of 28lb and the resistance between them through the core material is over 100 megohms.

Yet another choke submitted is intended for use in vacuum cleaner motors and so on to minimise interference in television receivers due to sparking at the brushes. It is provided with flexible leads and with the PVC covering should be suitable for mounting inside the motor.

We were impressed by the mechanical strength of the chokes which should give little trouble due to breakage of core or leads.



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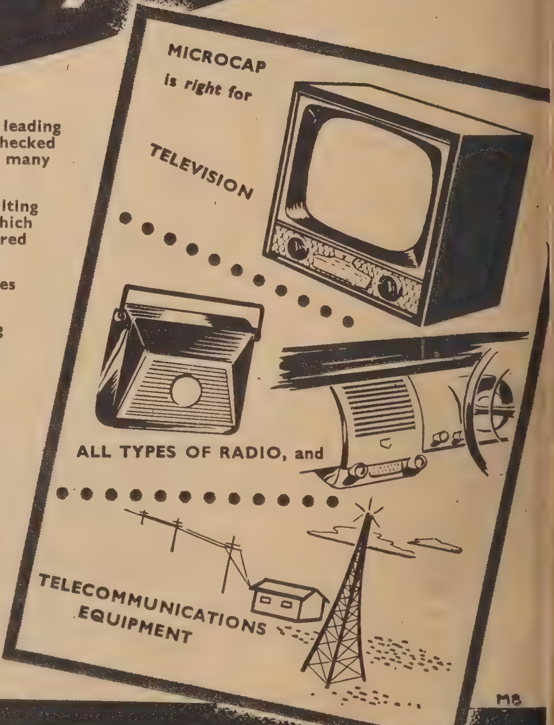


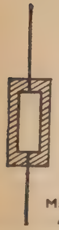
★ Here's the capacitor that is being fitted by leading T.V. Receiver manufacturers, who have checked carefully and **proved** for themselves the many advantages offered by Microcap—

Exclusive **metallized** paper construction, resulting in an ultra miniature space-saving capacitor, which can be fitted in a fraction of the space required for ordinary units of the same rating.

Outstanding "self-healing" feature, which enables Microcap to sustain accidental over-voltage.

Long, stable life in miniature form, reducing servicing problems, greatly overcoming the bugbears of "intermittent" and open or short circuits.

*Available in a wide range of capacitance values and voltages.*



Despite miniature size, note the generous non-hygroscopic moulding enclosing the capacitor unit: pigtails are soldered directly to unit by special process.

Manufactured in Australia under licence from
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## EW RCS COIL FORMERS

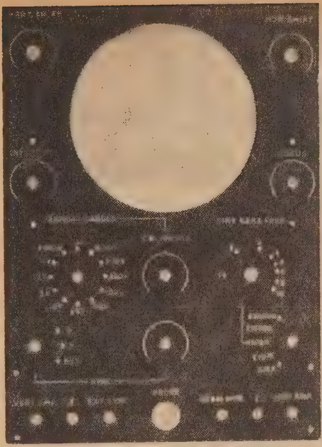
R .S. Radio are supplying miniature coil formers with fitting cans suit- for use in television receivers, short- receivers and other electronic pment.

ameter of the can is 7-8in, length former diameter 8mm. The base ailable with either four or five pins. ariable slugs are supplied with the They are ¼in diameter and ½in , made from ferrite material capable perating with low loss up to 60 s, well above the normal television mediate frequency.

he slugs are fitted with hexagonal of the standard dimensions, i.e., 0.11 es across the flats.

he thread of the ferrite slug corre- ıds with a thread cut into six ribs ch are moulded inside the former. iously there were four ribs, but .S. have found that the tendency for slugs to stick is less with the extra .

The RCS coil former in can.



A BLACK enamelled front panel, illustrated above, with all lettering included, for the R., TV and H. wide band oscilloscope is available from R. H. Oxford and Son P/L, of 97 Marriott Street, Sydney. The panel is intended to be placed in front of the mild steel front panel of the instrument proper and held in place by means of the control locking nuts. The base material is aluminium.

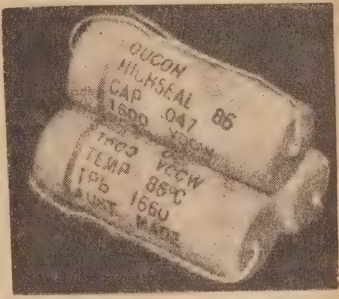
The finish is excellent and the panel will certainly help in giving a professional appearance to the completed instrument. Price is 19/6, plus 25 per cent. sales tax.

## DUCON HV CAPACITORS

TUBULAR capacitors which will find application in our 17in television receiver and other projects have been forwarded for comment by Ducon Condenser Ltd. The "Highseal 85" types illustrated have a capacitance of 0.047 uF and are rated to work at 1,600 volts. The overall length is 1¼in and the maximum diameter a little over 5-8in, type No. TPB 1560.

Also useful in television receivers are 1,000-volt working mica capacitors available from the same company.

"Hi-K" ceramic types are also available in high voltage ratings. One example of the last is rated at 1,000 pF and 2,000 volts working. It measures only ½in diam. and 1-8in thick and is therefore an excellent example of modern compact capacitor design.



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# A COURSE IN TELEVISION

## PART 23 — VIDEO AMPLIFIER STAGES (Continued)

Continuing last month's study of video amplifier circuits, we further discuss methods of video gain control, as utilised in most receivers to vary picture contrast. The rest of the article deals with the vital subject of frequency response.

IN a television receiver, the considerations which govern the placement in a circuit of the gain control are parallel to those which apply in an AM sound receiver. Over and above the obvious requirement to vary picture contrast—or sound volume—due consideration must be given to preventing overload, with strong input signals, of any stage or number of stages.

In early model television receivers, the video section operated at full gain and picture contrast was controlled by varying the gain of the high frequency amplifier circuits. Properly applied, this method also ensured that no stage in the receiver would be overloaded.

### USE OF AGC

Later, when a multiplicity of channels and other considerations made automatic gain control desirable, control of "front-end" gain was taken over by the A.G.C. system.

This levelled out obvious variations in signal strength and prevented overload but a subsidiary contrast control still had to be provided to compensate for inadequacies of the automatic control, variation in program material or variation in viewing conditions.

This subsidiary control is normally located in the video amplifier circuit though, in part 21 of this course, we gave the circuit for a contrast control which operated in conjunction with a keyed A.G.C. system, to vary the output from the video detector.

Provided the use of keyed A.G.C. is not an objection, this general approach has much to recommend it. It gives a wide range of manual control and avoids some of the complications which arise from trying to effect gain control in the actual video amplifier circuits.

The nature of these difficulties will be better understood by reference to figure 133.

Diagram (a) shows the normal potentiometer method, as used in audio circuits. The signal voltage developed across the total resistance of a potentiometer and any desired proportion of the whole may be selected by means of the moving contact.

The method is a very convenient one, because it gives complete control over the signal amplitude, from maximum to zero and need not disturb the operating potentials of the associated valves.

The diagram illustrates two possible positions for such a control—the usual one in the grid circuit of an amplifier and a second in the plate circuit. The latter position involves passing direct current through the resistance element which may or may not be considered desirable.

For all its merit in other respects, there is a serious objection to the potentiometer method, involving circuit capacitances.

In a practical potentiometer, there is inevitably some capacitance between the active terminal and the moving contact and there is a tendency for high frequency signal components to couple directly between these points, irrespective of the division indicated by the resistance element.

### LOSSES FROM SHIELDING

Shielding to minimise this shunt leakage would inevitably add capacitance to ground and introduce its own problems.

Capacitance to ground, affecting high frequency response, is always a problem in a video amplifier, as we shall see a little later. Normal practice is to keep it as low as possible and also to keep down the impedance of all active signal circuits. Such loss as may then still be apparent is compensated by providing a discreet amount of high freque y boost elsewhere in the circuit.

The right order of high freque y boost can only be provided if the l is known and constant. Herein lies other serious difficulty with figure (a). A significant proportion of capacitance to ground has to do with circuits connecting to the moving of the potentiometer.

But the impedance to ground fr this point varies with the setting of potentiometer, being often highest wh the tapping is near the centre of element. Allowing for this effect a possible capacitive leakage, as mentio earlier, the high frequency response m be so unpredictable and subject to alte tion that accurate compensation becon virtually impossible.

The complications to which this c lead will be explained later

### CATHODE FOLLOWER

A special case exists for the potent meter method, where it can be plac in the output circuit of a cathode-f lower stage. The net circuit impedar may then be kept low enough to mi mise the above complications, though automatically assumes a two-stage vid system.

Because of these problems, oth methods have been sought of controlli video stage gain, preferably without d turbing active signal circuits. One su method is shown in figure 133(b), volving a variation in the screen pote tial of a pentode.

Though this method has been used, is not above criticism. While variati of the screen potential does affect sta gain to some degree, it inevitably has much greater affect on the operating co ditions of the valve. Unless circu stances are fortuitous, the combinati of high input signal and low screen vo age to counteract that signal, will le to an overload condition and degener tion of the picture quality.

Another possible complication c arise from the variation in plate pote tial occasioned by a change on scre voltage. If the plate is directly coupl to another stage or to the picture tub manipulation of the contrast control c react on the said stage or on pictu brightness, with an undesirable or co fusing result.

Figure 133(c) shows a still furth method of controlling stage gain, whic finds fairly wide current use. It involv placing a variable, unbypassed resistor the cathode circuit of the video an plifier.

The intention is not to vary the bias, b to secure a greater or lesser degenerati loss in the cathode circuit, thereby alte

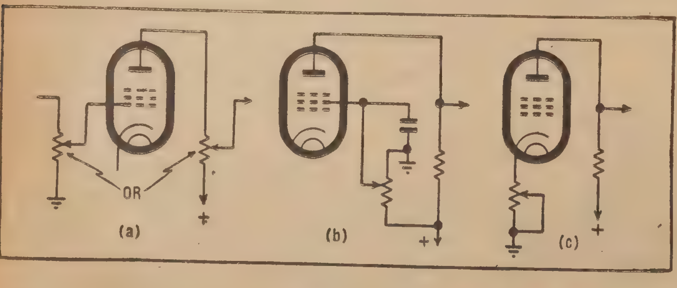

Figure 133: Three methods of video contrast control are illustrated here. Method (a) has capacitive limitations, (b) adversely affects valve operating conditions. Method (c) is probably the most practical and widely used.

ing stage gain. (The method is used in the R.T. and H. 17in receiver.)

Whether or not the bias is affected depends on the grid return path. If the grid is capacitively coupled to the preceding stage and returned through a resistor to its own cathode, then bias will not be affected. The reverse is true if the grid is returned to ground.

In the R.T. and H. receiver, the video amplifier grid is directly coupled to the video detector and therefore follows the excursions across the detector load from near zero at peak white to a substantial negative voltage on synch pulses.

## LITTLE EXTRA BIAS

The bias is therefore set predominantly by the detector but is added to by any voltage which may be developed instantaneously across the cathode resistor. Little standing bias is produced because there is no storage capacitor in circuit and, with large signal input, the cathode current swings freely between its dynamic limits.

On low signal input, when the detector bias diminishes and video cathode current rises, operation of the control to secure more contrast, reduces the amount of resistance in circuit.

Despite this, however, operation of a variable cathode resistor must have some reaction on standing potentials and may complicate matters in a directly coupled video system. There are no such problems, of course, where capacitor coupling is used.

The main limitation of the method is that it does not afford complete control between full gain and zero output. However, this order of variation is not needed for practical picture control and it is only a matter of arranging the signal level and gain from the video detector onward to effect all the video control that is necessary.

So much then for the matter of video gain control. It now remains to discuss the question of video amplifier response, which is closley related to matters of gain and voltage output.

The video frequencies involved in modern high definition television have already been discussed but can be mentioned again for clarity.

At the low frequency end, the limit figure is rather difficult to set, because it is confused by the possible use of direct coupling, or by AC coupling with or without DC restoration.

## DIRECT COUPLING

Where direct coupling is used, it can be assumed that any change in signal level, no matter how gradual, will be passed on to the next stage. In other words, the response can be said to extend to zero cycles per second.

However, it should be noted that this observation applies only to the directly coupled stage. If a coupling capacitor appears anywhere else in the detector to picture-tube signal circuit, it will automatically become a limiting factor as far low frequency response is concerned.

Again, if a directly coupled amplifier should involve a pentode with a screen bypass capacitor, some degeneration is inevitable, despite the DC coupling, at frequency where the screen bypass ceases to be effective.

Where AC coupling is used, the effect of all coupling as well as bypass capacitors is cumulative and, as in a conventional R/C audio amplifier, there will be some low frequency region in which the response will roll off quite sharply.

As a general rule, it is often suggested that the video amplifier should be able to sustain a potential at the picture tube grid or cathode for a period equal at least to the duration of one complete frame, or two interlaced fields.

The basis of the proposition is that an originally plain background should not reproduce as a noticeably shaded background from top to bottom of the screen, due to the loss of charge in the video coupling circuits, within the duration of one frame.

This implies, in turn, the ability to reproduce a rectangular waveform, having a repetition frequency of 25 cps. In terms of sine wave performance, this would amount to a nominal response extending to a few cycles per second.

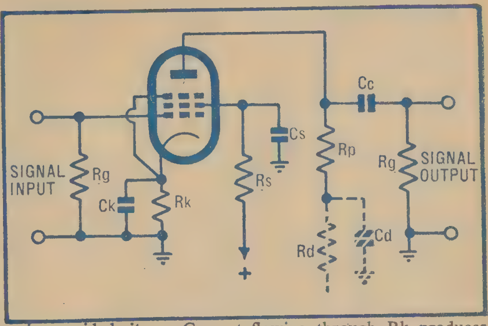

**Figure 134:** Here is the circuit of a conventional resistance-coupled amplifier stage. The article explains the components which govern low frequency response and a method of low frequency compensation.

Where DC restoration is provided, it serves to sustain signal levels for virtually indefinite periods and may, in this sense, be said to extend bass response to zero frequency. However, there is more to it than that.

Quite apart from the matter of frequency response, as such, the attendant problem of low frequency phase distortion must be considered in a television system.

Abrupt black-and-white divisions in the picture represent stepped functions, requiring a very wide range of frequency components for their reproduction, all in critical amplitude and phase relationship.

**BACK ISSUES**

IT is regretted that back numbers containing early instalments of "A Course In Television" are no longer available. However, we can supply isues from May, 1956, onwards at a cost of two shillings per issue.

If circuit conditions should cause a phase delay of only a few degrees at very low frequencies, it can still represent sufficient time delay for the low frequency changes still to be happening after the scanning spot has moved an appreciable distance from where each division should be.

In the case of horizontal divisions in the picture, the delay may be sufficient to affect two or three complete scanning lines.

Visually, this produces a lack of clarity and "weight" in adjacent areas of black and white, particularly in patterns and titles.

While some distinction can be drawn between phase and frequency characteristics, it is not far from the truth to say that the phase characteristics of a video amplifier will be adequate if the system has the suggested order of low frequency response, overall.

Phase and frequency characteristics at the high frequency end have yet to be discussed.

Figure 134 shows a generalised circuit digram for a resistance-coupled amplifier stage, with components designated, which are significant to bass response.

Firstly, there are the components in the cathode circuit, the bias resistor and its attendant bypass capacitor.

Current flowing through Rk produces a voltage drop across it, which makes the cathode positive with respect to ground and to grid. This is equivalent to applying an equivalent negative bias to the grid itself.

Because the cathode current varies instantaneously with signal, the voltage across it normally tends to vary in proportion and this produces a degenerative effect.

## CATHODE FOLLOWS

For example, if a positive-going signal is applied to the grid at a particular instant, the resulting increase in cathode current will cause the cathode to become more positive also.

The DIFFERENCE between grid and cathode voltages, which represents the effective input signal, is therefore less than it would be if the cathode potential had remained fixed. The tendency for the cathode to "follow" the grid potential thus produces loss of stage gain, being a degenrative effect.

In audio amplifier practice, this difficulty is offset by connecting a large value capacitor in parallel with the cathode resistor, a figure of 25 mfd. being quite common. The capacitor charges to the average potential developed across Rk and, due to storage effect, will not allow the cathode voltage to rise or fall significantly in step with the input signal.

In audio work, the lowest significant signal is usually reckoned to be about a 30-cycle sine wave and it is usually not very difficult to arrange that the capacitor have sufficient storage to be effective at this frequency.

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However, for television work, very low frequency components are much more evident and important to the end result and the problem has to be approached with greater care.

If the "storage effect" of the capacitor is to be adequate, it can be stated in other more technical terms, that the reactance of the capacitor in ohms must be less than the value of the bias resistor down to the lowest significant signal frequency.

Since this latter may be counted as only a few cycles per second and since the bias resistor for a high-gain video valve may itself be quite low in value, the difficulty of meeting the above requirement is obvious.

## POSSIBLE COURSES

Where gain is at a premium, a designer may be obliged to specify an adequate capacitor, even though it may be unduly large and expensive. Alternatively, he may devise a way of biasing the grid directly, allowing the cathode to be earthed.

More common practice in television receivers is simply to omit the bypass capacitor altogether. This causes a loss of gain, usually about 2:1, but since it is apparent at all frequencies, there is no discriminatory effect.

In the case of a pentode amplifier, consideration must also be given to the screen circuit. For correct operation, the screen potential should remain constant, irrespective of instantaneous variations in screen current with signal.

In a sense, the problem is akin to that of the cathode voltage but with the important difference that the natural impedance of the screen circuit is higher. The screen current is lower than the cathode current and the supply resistor much larger. It is therefore possible, by using a standard 8 or 16 mfd. electrolytic, to hold the screen potential constant against even quite low frequency variations in screen current with signal.

It should be noted in passing that the screen potential can also be stabilised by feeding it from a divider network connected between the HT line and earth (or cathode). Provided the bleed current can be made substantially higher than the screen current, degenerative loss will be slight and will be constant for all frequencies.

## HT SUPPLY IMPEDANCE

In the plate circuit, some significance taches to the impedance of the high-nsion line and power supply. This is so because, under certain conditions, the deo output stage may draw high current for a significant interval of time, equivalent to a very low frequency signal.

The increased current can conceivably react through the common power supply to another stage, to modify its gain.

As a rule, the power supply of a teleision receiver is of generous proportions with large filter capacitors (upwards of 00mfd) and power supply impedence is ot a serious problem.

Probably the most significant single omponent in terms of low frequency esponse, is the interstage coupling capaitor Cc.

Basically, its function is to isolate the DC plate potential from the signal output circuit but to pass to this circuit the entire AC signal component.

In fact, the signal current can be visualised as flowing through a series circuit comprising the coupling capacitor, the following resistor Rg and the valve combined with its plate load. The circuit is illustrated in figure 135.

If the coupling capacitor has negligible reactance, the current through the circuit is dependent primarily on the value of Rg and the parallel resultant of the valve's plate load and its own plate resistance. The voltage drop across Rg, which constitutes the signal output, is then the product of signal current times Rg.

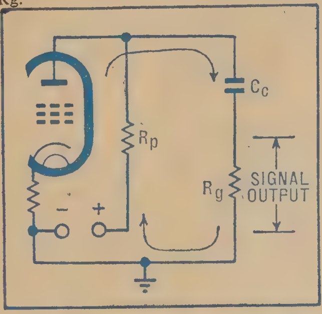


Figure 135: The coupmig capacitor in an R/C coupled stage is really part of a series circuit involving an AC generator (the valve and its plate load) a coupling medium (cc) and a load(Rg). When the reactance of the coupling medium rises, the current through the load and the voltage across it must fall.

The reactance of the coupling capacitor, Cc, will inevitably increase at low frequencies and, if it should rise sufficiently to modify the current through the series network, then the signal voltage developed across Rg must diminish. At the same time, it will be shifted in phase.

It follows from the foregoing that the amount of capacitive reactance which can be tolerated is directly related to the amount of resistance in circuit. If the net resultant of Rg, Rp and plate resistance is high, then the reactance of Cc can likewise be fairly high (or capacitance fairly low).

The same order of capacitive reactance in a circuit of low net resistance would be unacceptable.

## LOW PLATE LOAD

In a practical video amplifier stage, the plate load resistor, Rp, is normally quite low, being usually around 3,000 to 5,000 ohms.

On the other hand, Rg can usually be fairly high and certainly not less than 0.1meg. Therefore the value of Cc is largely set by the value of Rg. As the value of Rg is increased, so can the capacitance of Cc be reduced for any given order of bass response.

In general, the value of Rg is determined by ratings or requirements to do with the following stage, whether it be another amplifier or the picture tube itself.

Obviously enough, it should be kept as high as conveniently possible, in order that the value of Cc can be kept down. A coupling capacitor which is unnecessarily large is costly, difficult to mount and increases the chance of high frequency loss, due to stray capacitance.

## TYPICAL VALUES

Typical coupling constants, as used in the R.T. and H. television receiver are an 0.5 mfd coupling capacitor feeding into a 0.1meg following resistor. Calculation will show that the reactance of a 0.5mfd capacitor reaches 0.1meg only at 3 cycles per second.

This might suggest that the response is 2:1 down at 3cps but even this is not the case. Because of phase shift in the network, the actual loss when the reactance of Cc equals the resistance of Rg, is equal to about 3db.

In many television receivers, using only a single stage of video amplification, there may only be one coupling capacitor in circuit, namely between the plate of the video amplifier and the cathode of the picture tube. In this case, Rg would be the cathode return resistor.

The video amplifier grid is commonly connected directly to the video detector load, being biased by the voltage developed therefrom.

Where more than one coupling capacitor is used, or where low frequency loss is likely to be incurred elsewhere in the system, all such losses are cumulative in their effect.

In most cases, it is possible to preserve adequate low frequency response by attention to the foregoing details, choosing components of adequate value. However, should circumstances dictate an unacceptable amount of low frequency attenuation, some correction is possible in the plate circuit of the video amplifier. The relevant components are shown dotted in figure 134, being marked Rd and Cd.

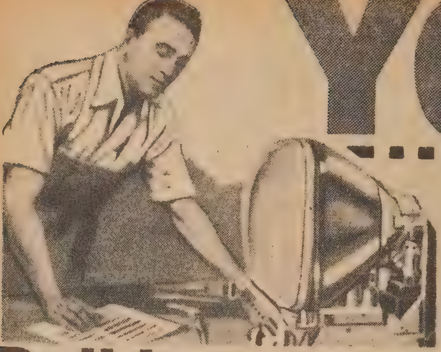
## LOW FREQUENCY BOOST

By way of example, if the video response should be down by 2:1 at some low reference frequency, the gain can be restored at this frequency by doubling approximately the effective value of the plate load. This can be achieved by connecting a resistor Rd in series with Rp as shown.

However, the additional gain must not apply for middle and high frequencies and, accordingly, the junction of the two resistors is by-passed with a capacitor of carefully selected value.

At middle and high frequencies only Rp must be in circuit, so that the reactance of Cd must be low. Approaching the low frequency end, the reactance of Cd must rise sufficiently to allow a small extra signal voltage to be developed across Rd. At the very low reference frequency, Cd must be ineffective, allowing full signal voltage to be developed across Rd and added to that across Rp.

The values for Rd and Cd can be estimated or determined practically to give close correction for low frequency losses elsewhere in the video circuit phase relationships being improved at the same time.



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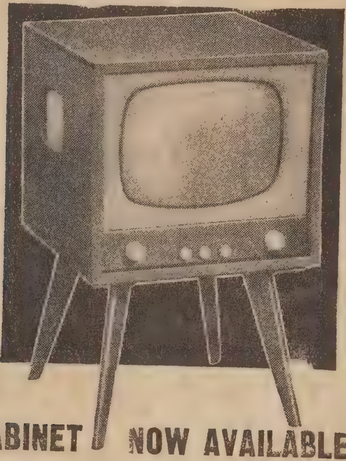

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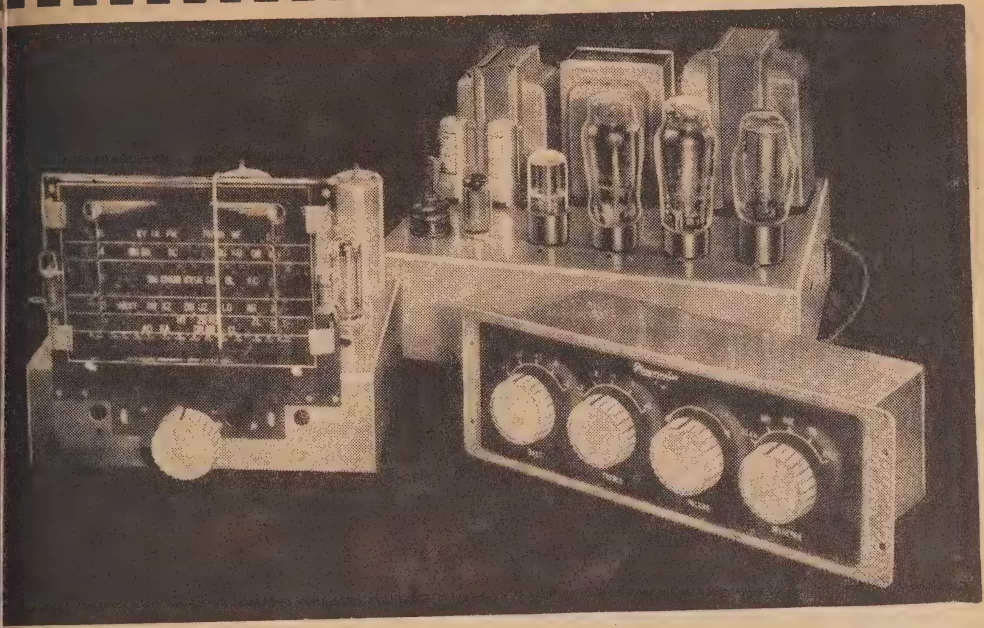

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ADDRESS ........................................

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# OFF THE RECORD — NEWS & REVIEWS

**Looking back over the long hours spent in listening to records of all kinds, I find I have bee wrestling with one problem in particular, that of deciding when a certain type of sound i appropriate to the music being played and when it is not. The problem is most acute wit the more complex combinations, but it exists even with solo instruments.**

IT is, perhaps, most profitable to consider the point as applied to the symphony orchestra, which has the greatest potential of sound and colour, and is easily the most popular in the classical field where such matters are important.

Time was when recording engineers could do little more than spray one or two microphones about the place and hope they got something that sounded vaguely like a symphony.

Today they can treat each group of instruments individually, pick out the soloist if any, and even add reverberation, either selectively or over the whole. Their microphones are so sensitive, and their mixing techniques so smooth that they can record in magnified form sounds which otherwise would be completely lost.

## SPECIALISED SOUND

For several years now, ever since this kind of thing has been going on, specialised treatment of sounds has opened up an exciting new field by which, through the medium of wide-range, low distortion equipment, we have been presented with a new and fascinating world.

And because records have to be sold, and because there is great competition in the field, more and more gimmicks have been thought up, and the search for vivid noise has gone on.

Now a good deal of music responds well to this treatment, and nearly all of it can be improved.

But where do we stop?

I have always put forward the position that records do not aim to recreate a concert hall performance, nor could they successfully do so for many reasons. They have given us a new method of hearing music which can stand in its own right and cannot be rivalled by any other method. I have even gone on record as saying that the performance on disc need not necessarily bear any relationship to what we hear at a concert.

## ONLY A PART

But this is only part of the story. It is I believe true to say that most of the world's best music was not intended to be heard through multiple ears, whose greatest sin is that they should miss a single note from a single instrument.

The composers in most cases wrote the music to be heard as a whole. Most of their sound colours depend on a blending of sound, not a separation of it. When such separation is called for, the score allows for it. Brahms, Beethoven, Mahler and Bruckner, naming but a few good examples, are simply torn to shreds when denied the necessary "air," to use a favourite word of mine for their big sounds to develop.

Less powerful music withstands close treatment much more successfully; chamber music is generally improved thereby.

But even then, there is little to be served by catching every indrawn breath, every sound of the pianist's pedal, and so on, for such forward presence cannot be relieved by playing at low volume or other simple domestic tricks.

If we do not strive to emulate a concert hall, at least we must temper our recording acoustics so that the original sonic idea of the composer is treated with appropriate respect.

## MULTI-CHANNEL

It may be that we have reached the stage where the recording engineers have outgrown the limits of their medium, and that multi-channel sound is the only way in which this problem can be solved.

For when we add a third dimension to music, the entire approach to sound colouration must change, and most of the techniques now applied to monaural listening will be abandoned.

But in the meantime there is no reason why we should not strive to temper our new found powers to the music in hand, so that, if we do not always present an ear-tickling sensation in sound, we do bring at least the kind of musical impact which the composer had in mind.

I would like to quote from Goddard Lieberson, President of the American Columbia record company, in an article which appeared in a recent issue of High Fidelity magazine. I could not express what he says more pertinently and I think it is good to read such things from a man who makes records.

It is only fair to say that many recording executives would agree with him.

"For most people, a 'recording' has the quality inherent in the basic meaning of that word: something set down for remembrance, a record of previous aural experience that was pleasurable. And when a recording introduces us to a new listening experience, it soon becomes again a "record" of the first listening. The job of the record maker is very often that of recalling with excitement a previous experience of the auditor. He must do this with skill and integrity. I use the last word because there is often the temptation to create excitement, or spectacular sound, at the expense of historical accuracy.

### by John Moyle

In considering new paths in electr in terms of music, there are mom too, when it is necessary to pause artistic identification and ask ours if the microscope is not being ap too diligently on the behalf of hyper ism.

Are we, in fact, distorting the poser's concept and consequently a serious dis-service to music?

I remember once speaking to A Copland concerning certain recor of his music, and he confessed tha now heard inner voices in his com tion which had not only never clearly delineated in concert hall formances, but had not even been he I think he was more surprised either disturbed or pleased by this. I am not sure yet whether or no has given it very much considera though I should think he had.

But in any case, Aaron Coplan very much alive, capable of spea for himself, and able to protect music from whatever developments the moment he might consider as fringing on his prerogatives as a c poser.

## OLDER COMPOSERS

But what about the dead compo and their music? Are we doing a ser to music when we reveal all of threads in its tapestry? I suspect not.

I know that a composer very o writes incidental orchestral figures complicated ostinatos as a backgro of sound — and these sounds are viously not meant to be heard either a pattern or as thematic material. one can possibly believe that many the inner figures in, let us say, a score Richard Strauss or Maurice Ravel meant to be heard in any way ot than as a general sound, one might almost as a sound effect.

Yet, today, there are certain quart where a piercing cry of joy is emit when the ring of a triangle or the cl of a cymbal is heard all out of p portion to the composer's intent, when a small rhythmic figure in a h is given the stature of a theme thou its original purpose was merely atn spheric. And, in my opinion, this devilment not only happens to the mu of the romantic or modern composer.

## FREQUENT DISSERVICE

Classical music, too, very often suff this same disservice. Although it is qu likely true that even in concert perfor ances we are not hearing Mozart Beethoven symphonies, Bach, Handel, Vivaldi orchestral works in the sa proportions, or, if you will, the sa sound weights, in which they were co ceived, yet those disproportions are pro ably less grotesque than they are und electronic magnification.

Therefore, there is still serious wo

lone in achieving standards in the f recording which will give the ng industry an objective

W that objective be the reproduc t a concert-hall sound, and if so kind of concert hall ?

F my part, I would choose as the rd the objectives chosen by the ser himself in his own era with all limitations of that era. I am not y means against experimentation t us have that in the work of living omposers, or living inventors of who can create specifically for honograph as a musical instrument life of its own, which indeed it

en in the light of the subject under sion we speak of man's conscious and of his thinking ability we are also to the consideration of his ual life, or at the very least, his life as it is related to sound. That e thus far concerned myself chiefly pragmatic aspects of recordings not mean that I look upon electronic developments only from the vantage point of empirical psychology On contrary, I believe that the science lectronic recording, deeply inter ed as it is with human emotions c, or speech, has its own mystique

### MRE TO BE EARNED

ecently, at a recording session, when interminable adjustments and in erable discussions, the balance of d came perfectly into focus. I ask engineer colleague for an explanation of what changes had accomplished miracle He could only shrug and it that he didn't know couldn't be When I said, "Do you mean that e are still mysteries in this business?" answered fervently "Yes, thank G"

(End of quote)

's true, isn't it? There are records which move me for reasons which an no more explain coherently than n fly unaided. It is in fact one of the f mental tortures of a critic that must eternally strive to do just that wing that only the sound itself will vide an adequate eloquence.

Maybe its something to do with one's ognition of an aspect of truth when h meets it, even if he cannot find the words to acclaim it.

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## ECORD REVIEWS

**HAYDN Quartet No. 39 in C ajor, Opus 33, No. 3 (The Bird); uartet No. 78 in B flat major, Opus 6, No. 4 (Sunrise). Played by the uartetto Italiano Columbia 330CX. 383.**

I often wonder just how these distin ishing names are worked out. I can dly suggest that, if they be used at all should be for identification only for ny are misleading and often provide bias in the mind which, in seeking to d justification for them, loses its full joyment.

In Haydn's case he wrote such a large mber of quartets that he repeated him lf in many keys and maybe a name easier to remember than a number.

These two betray their chronology ite clearly; 39 has a freshness about it hich we don't find in 78

The Italians play this latter at rather steady pace, delicately and carefully the last movement, for instance, a brighter mood would have been in order, although they become brisk enough at the finish.

It is rewarding music, with more than a touch of the earlier Beethoven, although the impression soon dies on the practised ear

The similarity and distinction is even more marked in the earlier work, particularly in the adagio

This movement is a good example of the Quartet's style—classical and fine, almost thin at times, devoid of any heavy romanticism or unduly exaggerated tempo

The Rondo which follows shows their excellent ensemble and technical mastery

They are not a full-blooded combination—the final bars of this movement do not end with a flourish to give an air of finality.

No doubt their justification is that he music [illegible] written that way!

The recording is sharp and clear, not overmuch body, but amenable to some top cut and bass boost Here and there the leader's intonation is uncertain but not enough to [illegible] the effect

A quiet surface allows full appreciation of some exquisite quiet passages played with beautiful control

**CHOPIN—Sonata No. 2 in B flat minor, Opus 35; Sonata No. 3 in B minor, Opus 58. Played by Julius Katchen Decca LXTA 5093**

Katchen is not a traditional Chopin player by any means. He takes hold of the music as though he intended to really do something with it, but too often invests it with [illegible] which are hard to justify.

In fact, some sections of the score are difficult [illegible] identify, but, to be honest, they are not easy to make much of n any repertoire

But his firm handling and controlled emotions might well go down with those who don't like their Chopin sketched too lightly His are powerful performances

At the same time, Chopin is an elusive composer, and the harder one tries to nail him down, the more often he avoids he hammer

Unless the music is allowed to make itself, it often fails to emerge at all Katchen divides his time largely between declamation and fussiness. Often he rattles off an episode as though his main purpose is to get it out of the way He is much preoccupied with his own playing.

As expected, he makes a big thing of the Funeral March a strange Chopin interlude, and plays the fast display passages with firm authority

The piano tone is convincing, its acoustics well placed and it sounds impressive

**MILSTEIN MINIATURES — Thirteen small pieces for violin and piano played by Nathan Milstein accompanied by Leon Pommers Capitol P-8339**

Many favourite shorter pieces for the violin are included on this record, most of them arrangements such as Chopin's Nocturne in C sharp minor, Vivaldi's Siciliano, Flight of the Bumble Bee Meditation from Thais, and so on.

Milstein is a lovely violinist, sensitive to a degree, brilliant without being flashy, and with an intonation as steady as a rock

He is also a very heavy breather and it doesn't take very close listenin

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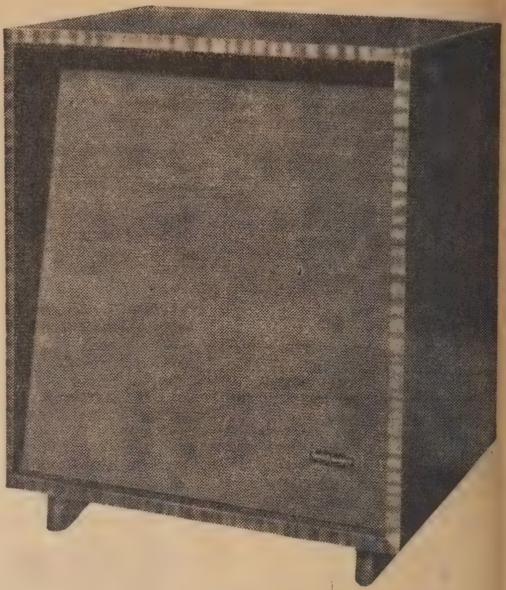

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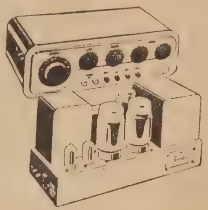

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is pants behind the music.

The recording is sharp and forward — found a notch of treble cut a good thing to take some shrillness off the top.

I think you will like the way in which he changes his mood to fit the music, and the even balance he achieves with his accompanist.

A good example of this is in the Siciliano of Maria Theresa von Paradis. …in does this kind of thing very well indeed.

The surface is inaudible.

**TCHAIKOWSKY — Piano Concerto No. 1 in B flat minor, Opus 2… Played by Paul Badura Skoda and the Philharmonic Promenade Orchestra, conducted by Sir Adrian …ult. Nixa NCL16013.**

Low tension performance, analytical to the point of pedantry at times, played carefully and conscientiously, particularly the pianist, who is neat rather than …ty, correct but not fiery, and, let's face it, not powerful enough to match the strong performances we have heard on other discs.

The Philharmonic Promenade Orchestra is probably the London Philharmonic under another name, but it doesn't sound quite as well as on other occasions, if my guess is correct.

It tends to wash out in the light passages.

…me if its instrumentalists, particularly the brass, are allowed to play only here and there.

The piano is well to the fore, which is just as well, for it doesn't get there by brute force. Some of its heavier notes do not come through cleanly by today's standards.

The slow movement has some effective movements but even here the tone is rather thin although some bass boost …ed it out.

I'm afraid this effort is a pale one when stacked up against the field.

**DEBUSSY — Apres-Midi D'un Faun, Iberia, La Mer. Played by the Detroit Symphony Orchestra conducted by Paul Paray. Mercury MG50101.**

Outstanding on this disc is the clearly etched sound. That's the best description of it, for its definition is quite remarkable.

It is one of the things that makes Afternoon of the Faun so successful.

This is one piece which demands the clearest possible articulation from every participating instrument. And no concert hall ever presented them as delicately as Mercury has here.

It is, in fact, an extremely good version from this point of view, although, as with most American discs, a little less presence and a little more air would have put the seal upon it.

The same general story goes for the other two items. There is probably not a cleaner La Mer on records at the moment, and if there isn't all the magic the music contains, there is fine articulation and extreme brilliance.

But it's the delicacy of the recording which is always most noticeable — the lightest touch of a triangle, almost 3-D in its sonic placement, the sparkle on instrumental tone, the edge on the woodwind and firmness of the tone which excites the admiration.

The surface is beyond reproach — as I have so often remarked we expect this kind of engineering today, and what a difference it makes to a performance of this kind.

On all counts, this disc scores highly.

# WALTER'S BRAHMS IS HIGHEST QUALITY

**BRAHMS—The Four Symphonies. Played by the Philharmonic Symphony Orchestra of New York, conducted by Bruno Walter.—Coronet.**

These discs were released some time ago under another label, but as the originals were American Columbia they now revert to Coronet, who have reprocessed and re-issued them in a handsome, spiral-bound album.

The album also contains the front pictures and back annotations of the jackets normally supplied with single discs.

All this makes a tempting package, for these Walter versions of Brahms are among the best there are.

Walter is one of the last of the old classical school, and he makes this clear at the first bar.

He is completely at variance with those who modernise Brahms, tightening up his meandering ways, shining their batons on his mighty climaxes, and generally doing him over with super-gloss.

The truth is that Brahms was a romantic and at times woolly-minded man, and most of his symphonies is touched with rosy glow.

If you do not approach them in this light you will grind much of the substance out of them.

Walter errs, I think, in his own romanticism, and relies upon it too heavily. Among many examples is the second movement of the Second Symphony, in which those long, undulating passages could have been handled with less prolixity without prejudice to the lovely sound he makes.

And the opening of the Fourth is far too slow.

You will probably look, too, for stronger climaxes, as in the end of the First Symphony.

But his feeling for the graciousness and gentleness of Brahms is there. Listen to the third movement of the First, how he handles each phrase as though reluctant to leave it—we can almost hear his sigh of nostalgic regret as the last notes die away.

Walter does not appear capable of reaching moments of real tension or high pitch. I feel that he hits them with pulled punches, when the addition of some real fire might have been electrical.

But these somewhat analytical remarks cannot lessen the fine qualities of these records. Not the least is their technical quality despite some lack of the brighter tones of today.

I liked the distribution of weight and instrumental tone. Brahms must have an orchestra that sounds big even when few instruments are playing; an inner definition to avoid muddiness, and the right reverberation or it will sound thin.

In these respects, both orchestra and recording are most un-American, and in this case better for it.

Already I have considerable affection for these performances, and after all that's strong recommendation. Such records will never stand neglected.

They are perfectly clean and have no noticeable surface noise.

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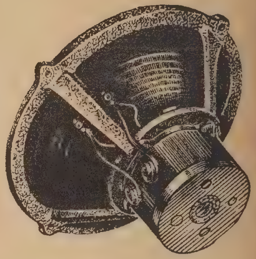

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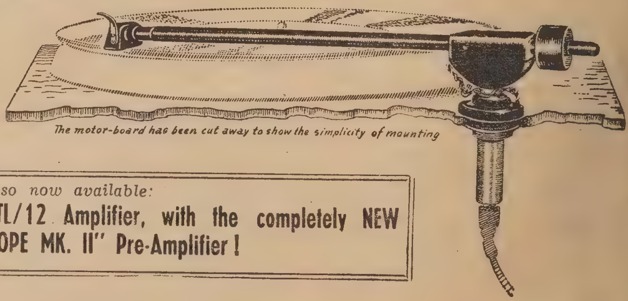

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**HADWICK. — Symphonic Sk hes; Jubilee, Noel, Hobgoblin an A Vagrom Ballad. Played by the Ea nan-Rochester Symphony Or- ch ra, conducted by Howard Han- so Mercury MG50104.**

Ch lwick was of the school of Ameri- mposers which flourished in the alf of the last century along with McDowell and Paine. He was a r of the New England Conserva- the home of serious American for nearly 35 years.

A might be expected, much of his showed the influence of Dvorak Brahms, for not only was Dvorak ninent figure in New York at the but Chadwick, in common with musicians of the day, finished his in Germany, and the combina- must have been irresistible.

T influence is most prominent in st two sketches, written some years the last two, and the change in between them is most marked. Jubi- d Noel are the most often played se they are the most tuneful and twise. They are, in fact, well worth e in any program.

Hogoblin and Vagrom Ballad seem mental by contrast, as indeed they and many American composers came under Chadwick's influence ved similar lines into brave colour ffects.

e Eastman-Rochester Orchestra al- puts on a brilliant show, which ury's recording technique is designed. centuate. I thought it rather un- ced at the top end, and preferred ay it on the old E.M.I. curve, with extra bass, to tone down the highs add more body. Despite the claims on the jacket, I did not think many rtant passages for individual instru- s were picked out as well as they ved, although everything which is is very clear.

d many weighty bits, played at good ne, are of demonstration standard.

**BRAHMS.—Symphony No. 4 in Minor Opus 98. Played by the enna Philharmonic Orchestra, con- cted by Rafael Kubelik. Decca TA 5214.**

is is a fine performance of the rth, a contrast in many ways with of Bruno Walter but comparable as ccessful effort.

belik treats the music more urbanely, analytically than Walter—it moves e quickly even when there is little al difference in tempo.

s outlines are not quite so completely d out. Kubelik's conception is a der one, and his texture more tightly nd together.

s might be expected, his excitement the greater heat, although the actual rding is more remote.

he players, too, have their own oth quality of tone which is not easy mistake, although, as I have said, Wal- s players sound quite unlike the sharp erican fashion.

t is, in fact, an extremely fine per- mance—among the best of a good ection.

here is more top to it than there is Walter, although the cutting ampli- e isn't as high. Volume for volume, hows signs of having been made at a r date.

he surface has the faintest of rustles. enough to prevent it from being d quiet.

**MENDELSSOHN — Piano Concerto No. 1 in G Minor, Opus 25; Piano Concerto No. 2 in D Minor, Opus 40. Played by Peter Katin and the London Symphony Orchestra conducted by Anthony Collins. Decca LXTA 5201.**

The concertos of Mendelssohn are patchy things. They combine an air of simple sincerity with some beautiful melody; they mix his stylised and often inadequate handling of the orchestra with some passages of great banality, and tiresome pre-occupation with poor ideas.

But they are things one comes back to occasionally with untroubled enjoyment —they create an atmosphere of pleasant well-being it is hard to define.

Perhaps it is because one can idly think of other things while listening in ruminative mood without danger of missing anything highly important.

By no manner of thought can they be described as demanding music. Peter Katin strikes just the right atmosphere in his clean, graceful performance. If he can't prevent the music from sagging occasionally at least he keeps it going, nor does he draw attention to its limitations by an over-ambitious delving for what is not there.

Collins' orchestra plays in much the same vein, very nicely, too, and if his tempos sound wooden at times it may not be altogether his fault.

In short, Mendelssohn here is dealt with adequately, and even with distinction, and the recording has made sure it is all clearly audible.

One can hear the piano hammers bounce very smoothly from the strings, and only occasionally does the tone run a little hardly.

Only real criticism is that my copy has a faint surface swish on each side, which may not be characteristic of them all.

**GALUPPI—Quartet in G Minor. BOCCHERINI—"La Tiranna Spagnola," Opus 44 No. 4. CAMBINI —Quartet in G Minor. Played by the Italian String Quartet. Columbia 330CX 1408.**

There is a vast amount of chamber music which today is never played and, apart from its historical value, no doubt it isn't very much missed. The universal appeal of orchestral music has pushed even the better-known quartets into the background, which makes it even more surprising to strike this disc among recent releases.

Galuppi was born in 1706, Boccherini in 1743 and Cambini in 1746, all in Italy. Galuppi is the most serious-minded of the three and we are not surprised to learn that he was much admired for his craftsmanship.

There is a great difference between his scholarly and rather pedantic style and the more facile work of the younger pair, whose work has much in common.

It was, in fact, a habit of Cambini's to compose in the style of Boccherini and have his compositions published as the real thing.

No doubt his adventurous life and scapegrace tendencies had blunted his scruples about such matters.

And yet his own quartet here is the longest and the most satisfying of the three.

As all the music and two of the composers are new to me I can only say that the Italian players handle their performances in their usual distinguished style and that the recording is much the same as we have from them in records already released.

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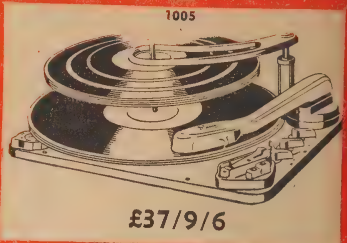

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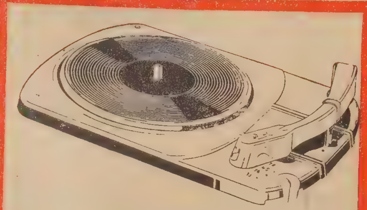

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# COOK TEST RECORD IS UNIQUE

normally possible to make dis-
n measurements on audio equip-
hout special test gear, and even
eliable, quick checking method
to find.

frequently used is the inter-
on test, for, besides being the
to observe, it indicated to some
he presence of other distortion
nd even their magnitude, for
nal analysis all types of distor-
inter-related.

Cook's ingenuity and ability
gineer are both reflected in his
m test record, for detecting the
lulation distortion of a complete
ain centred around a figure of
ent.

his disc he has recorded two
ne gliding from 20,000 to 4,000,
other from 19,000 to 3,000
simultaneously in the same
Because these tones are always
d by 1,000 cycles, any non-
in the system will produce not
two tones, but a third tone of
ycles, the difference frequency be-
hem. The greater the degree of
arity, the louder will be the 1,000
ote.

because non-linearity is the cause
modulation, the presence or ab-
f the third tone is a direct check.

## ECT CHECK

hat the amplitude of the inter-
ted note can be estimated, Cook
perimposed on his recording a
1,000 cycle note at an amplitude
to 2 per cent. distortion product.
de is in the form of the dot-
epresenting the Morse Code letter

no distortion present, the lis-
will hear this succession of "A's"
hout the disc, together with the
tones when these fall within the
range.

here is distortion, the intermodu-
note will begin to fill up the
between the coded signals. If it
exceed 2 per cent., it will over-
w them, thus turning the dot-
into dash-dots, the Morse Code
l for the letter "N." If distor-
hould exactly equal 2 per cent., a
tone will be heard, at 1,000 cycles.

## RECORDING

record pre-supposes a very low
e of distortion during recording,
he fact that the technique succeeds
is a direct evidence that Cook's
is high-class.

check on several amplifier systems
sufficient to show that the disc is
ful test, for results were varied and
recognisable. I was, in fact, quite
essed by the monotonous regularity
which "A" was produced on my
gear. Only at one small spot
nd 14 Kc did it show any tendency
nvert to "N," and, according to the
t note, the distortion in recording at
point is only 3 db under reference,
ts a normal minimum of 10 db.

One side has two such tracks at 33 r.p.m., with explanatory notes spoken by Bob Bollard of Cook's, together with a third inner section recorded at 78 r.p.m. microgroove. This speed change allows a cross check to be made should there be any suspicion that the record itself is at fault.

The second side duplicates the first, but is intended for binaural tests using Cook's twin channel records.

## OVERALL TEST

Note that this is an overall test, covering pick-up, amplifier and speakers. By a process of substitution, it is often possible to track down which section is the offender. It is particularly useful for pick-ups and speakers, both of which are most difficult to analyse, even for experts.

The disc would have been even more useful if the second side had been a duplicate of the first, or combined with a frequency run. Maybe the manufacturers can be persuaded to do something about it at some future date.

In the meantime it appeals as a most valuable and unique method of test.

**KHACHATURIAN. — Concerto for Piano and Orchestra, played by Leonard Pennario with the Concert Arts Orchestra conducted by Felix Slatkin. Capitol P-8349.**

The sound is particularly bright and sharp—no furry edges here, cracked piano notes or fluffy cymbals. It is brilliant to the point of hardness, for Capitol has kept the upper and middle registers well to the front, to the detriment, I think, of the heavier and rounder sound.

To a large degree this treatment is not out of place; for except for the romantic slow movement, the musical outlines are sharp edged and often harsh.

I rather liked this description of it contained on the record jacket:

## ROMANTIC TRADITION

"The concerto is in the grand romantic tradition that stemmed from Liszt and had a gorgeous flowering with Tchaikowsky and Rachmaninoff. Technical virtuosity is the hallmark of the tradition, and Khachaturian is not reticent; he thunders up and down the piano with fine authority, embroiders his melodies with fantastic arabesques to show off the facility of small-muscled fingerwork, interpolates cadenzas, frames the solo part with highly coloured orchestral sounds, builds sonorous climaxes — in short, sets up a musical economy which requires a large investment of physical energy but which also pays enormous dividends."

In general, all these things are present in this record. Certainly the pianist is most brilliant, with the breath-taking speed and certainty so characteristic of American performers. He is inclined to personalise the part whereas I see no personal feelings in this music. It should be played from the outside, and not the inside, its emotions, such as they are, are those of a spectator and not a participant.

The orchestra sounds loud but not big, apparently fairly closely miked in a hall with ample reverberation.

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DORATI
conducts the
MINNEAPOLIS
SYMPHONY
ORCHESTRA

ANTAL DORATI

TCHAIKOVSKY
1812
FESTIVAL OVERTURE
ON
Mercury

TCHAIKOVSKY
1812
FESTIVAL OVERTURE, Op. 49
CAPRICCIO ITALIEN
ANTAL DORATI
Minneapolis Symphony Orchestra
University of Minnesota BRASS BAND
BRONZE CANNON Strasbourg, France
BELLS of the Harkness Memorial Tower
Spoken Commentary by DEEMS TAYLOR

This recording contains a track used solely for the explanation of how the live cannons (to simulate the Franco-Russian battle) and the bells of Harkness Memorial Tower, Yale University (to simulate the Russians' victory over France), were recorded and dubbed into the music, at the required time. This spoken commentary is by Deems Taylor. On the reverse side of this disc is a beautiful recording of CAPRICCIO ITALIEN, also recorded by Antol Dorati and the Minneapolis Symphony Orchestra. MG50054 12in L.P. 57/6.

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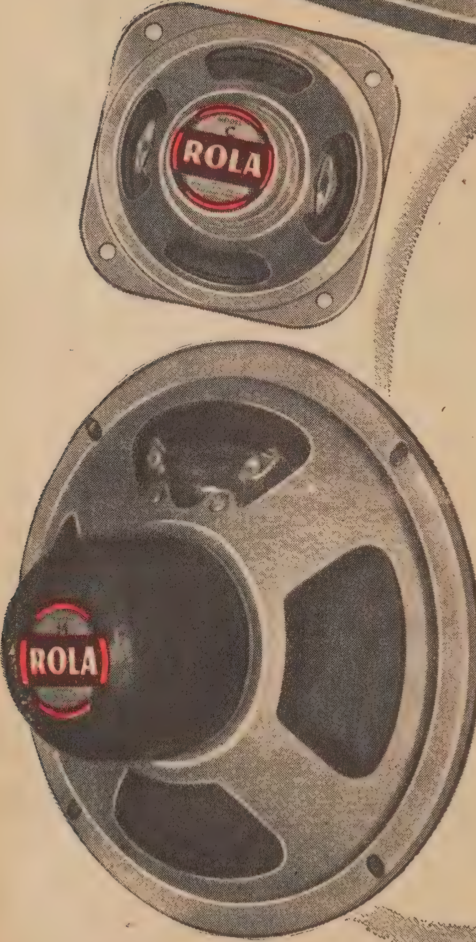
# The TV Pair



These two new Rola loudspeakers, Models 6M and 3C, are particularly suited for use in table model TV sets where space is at a premium, yet adequate facilities must be provided for the extended range reproduction available from TV's frequency-modulated sound channel.

Both new speakers incorporate the famous Rola "Fluxmaster" principle which eliminates the stray magnetic fields which can distort the TV picture.

The response of the high efficiency 6M takes care of the low and mid frequencies while the conveniently sized 3C can be front-mounted to provide top response and forward-projected sound which gives "presence" and perspective to the TV set's audio.

**ROLA COMPANY (AUST.) PTY. LT**

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**F LLA — Three-Cornered Hat ar :s; PROKOFIEFF — Suite or the Chout Ballet. Played by e l. Louis Symphony Orchestra. or ucted by Vladimir Golsch- ar.—Capitol P8857.**

he performance of the Three- ned Hat Dances are notable more th r vigour than their style — the iu or plays up effects rather il The recording is bright — the g have a forward edge, the drums h d. The net effect is reasonably t rather noisy.

h Prokofieft is to my mind much e ccessful. It may, in fact, be the ecording yet released, and is a e om a Ballet of the same name.

h it is the French rendering of the si word for Buffoon, and the story Russian folk tale of magic and e anding, fantastic in conception rthy in execution.

he is little that can be said of the that does not apply to Prokofieff eral. There is the same sharp- wit, contrasting and economical es and pointed satire.

recording is rather better than reverse side, and I get the im- n that this is the kind of music chestra likes best to play.

ace is good—a little bass re-in- ent might improve the sound.

**ISZT.—Concerto No. 1 in E Flat or; Hungarian Fantasia. Played Geza Anda and the Philharmonia hestra, conducted by Otto Acker- n. Columbia 330CX, 1366.**

la's gentle treatment of Liszt was nexpected, remembering the virtues s past performances, but it does most unusual when compared with owerful brilliance most pianists for.

st of his attention is given to the quiet melodies of both works. he extends to the limit in both and mood.

e orchestra, on the other hand. ers the piano with great zest, as gh its role has been tempered to st the quietest piece of Liszt playing ve heard in a long time.

I think you will have to like deft, closely analytical performance to really enjoy this one. Somehow Liszt without the flash and the fire and the bluster can sound rather empty and dull.

Anda is always a fine pianist, and he has no difficulty with the mere technical problems. He makes the romantic passages sound smooth and lovely.

But he isn't a traditional Liszt exponent.

The piano is heard extremely clearly and the orchestra complements its part without impatience.

If you are looking for Liszt with a difference, this is it.

**VERDI OPERATIC RECITAL.—Selections from Un Ballo in Maschero, La Traviata, La Forza del Destino, Aida, Falstaff and Il Trovatore. Sung by Joan Hammond with the Philharmonia Orchestra conducted by Glauco Curiel. HMV OALP 1407.**

This is the most successful record of Joan Hammond's so far issued.

Her vocal control seems to have vastly improved during the past year or two. She still retains that fierce acceleration to full voice which can be so disconcerting and which in the past has rendered her singing a thing of fits and starts, with little colour or subtlety in between.

But there are times as, for instance, in the selections from Aida, when she judges her tones extremely well, and although they do not achieve that fineness which comes more naturally to a lighter voice, they are steady and convincing.

Theatrically, she is now more animated; her emotions sound more as though she felt them and less as though she had made them up.

I say these things gratefully, for in the past I have not been able to enthuse over her records. If you are already a Joan Hammond fan, you will welcome this disc as a minor masterpiece.

Once again the Philharmonia Orchestra proves a tower of strength. There are too many fine moments on its part to list them all, but listen particularly to the violins at the commencement of the Traviata aria.

On records, at least, this is the best of Joan Hammond.

**OPERATIC ARIAS VOL 2 — Selections from Mozart, Cilea, Catalani, Mascagni, Rossini and Refice. Sung by Renata Tebaldi and the Orchestra of the Academia di Santa Cecilia, Rome, conducted by Alberto Erede.—Decca LXTA 5220.**

Any record of famous arias sung by possibly the leading operatic soprano of the day is bound to be good. All these appear to be excerpts from complete recordings, and they give a good cross section of Tebaldi's repetoire.

Not all will be as familiar as the Porgi Amor; E Susanna non bien; and Dovo sono from the "Marriage of Figaro," but they are all sung just as effectively with that quality which can only be termed peerless.

I am a Tebaldi fan. I am always ready to listen when she sings as beautifully as she does here, and is as well recorded.

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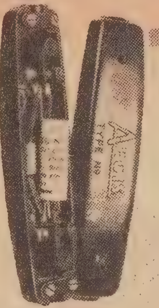

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# SHORT-WAVE NOTES BY ART CUSHE

## HCJB CELEBRATES 25 YEARS

A first-hand insight into the progress of HCJB in Quito and the plans for this station in the future were gained in a recent interview.

THE past and future of HCJB was outlined to us when Mr. Frank S. Cook, of Radio Station HCJB, Quito, visited Invercargill recently. From the information gathered a fine picture of the work of the station, which has a mail response from listeners of nearly 1,000 letters each week, could be obtained.

### TRANSMITTERS

The stations is now using a new 50,000-watt transmitter, and this can be cut to use two frequencies, and present indications are that the transmitter has been increased somewhat to now give some 40,000 and 20,000 watts respectively. The two transmitters can be worked in the 16 and 25-metre band in parallel, or in the 19 and 31-metre band in chain.

Four other 10,000 watt transmitters are in use, and one of these is in the 49-metre band, and the other taking the frequencies not covered when the 50-or 40-20 Kw stations are not using the frequencies.

The old 10,000-watt transmitter, which has been in service since 1940, has been dismantled and is now being converted into a new 50,000-watt station. This will operate on the broadcast band frequency of 700 kilocycles and also on the shortwave channels.

### TRANSMITTING SITE

The transmitting station at Pifo occupies some 45 acres and is shaped to give maximum use of the area for the antenna layout. The masts are about 300ft high, and one of these is visible in Quito. It houses the F.M. link with the studios

### STUDIOS

The studios occupy a city block in Quito and are connected to the transmitter by three F.M links, these carry the two programs, Spanish and the overseas service, and the other provides communication facilities, the station having an inter-communication system connecting some 100 points.

The large studio has modern acoustic treatment and there are several smaller studios for announcing. The studio also has a room housing F.M. receivers and a small 500-watt transmitter used for the Spanish programs and for official Government information broadcasts to the area the Government relying on HCJB for help in thi direction.

### STAFF OF 200

The station has a staff of close on 200, including 87 missionaries. Broadcasts are for 24 hours a day, except on Monday, which is the Tuesday reception in this area. The station also supplies the villages with small 4-tube, pretuned receivers and runs hospitals and other services for the community. Since the increase in power it has met with tremendous listening response in this area and New Zealand, on a population basis, must rank as one of its main areas of listeners.

The station in the future plans to operate from Europe, but as most countries do not have commercial or sponsored programs, the field is very limited.

Monaco, Luxemburg, Saar and Tangier, in North Africa, are the only fields available, and the construction of a transmitter to cover this vast European audience would be a major step.

Listeners' letters to HCJB are welcomed and many are answered in the Program Note session on Saturday at 5.15 p.m. on 9,754, 11,915 and 15,105 Kc. The station operates on these frequencies from 4.30-8.0 p.m. in the Southern Cross Salute, directed to listeners in Australia and New Zealand.

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## Dux Radio—Tangier

A NEW Swedish commercial station broadcasting from Tangier, North Africa, with programs beamed on Sweden has been heard testing on 9340 Kc from 5 a.m. to 7 a.m.

The signal strength is good and the station uses both Swedish and English in the announcements which are given frequently, while the popular tune, "Swedish Rhapsody," seems to be the musical identification they plan to use. The station has some Morse interference, but strength is of good entertainment value.

The station gives this announcement: "This is DUX Radio, Stockholm, Tangier. Dux Radio is a new Swedish advertising broadcasting from Tangier, North Africa. We would welcome a report on reception of this broadcast in your area and send this to DUX Radio, Stockholm 12, Sweden. We will reply with our station card."

It is expected that regular programs in Swedish will soon be carried on the frequency. As the Swedish Broadcasting Corporation is non-commercial, the station plans to cater for the commercial sponsors from the broadcasts from the International Zone of Tangier.

Notes from listeners should be sent to Arthur Cushen, 212 Earn Street, Invercargill, NZ. All Times are Eastern Australian.

## Perth on 6130kc

AFTER a lapse of over four years the Perth transmitter of the A.B.C. has returned to 6,130 Kc. It now uses three frequencies in its day's operation, while the lower powered VLW station has broadcasts on two channels. The complete schedule of the Perth service is now 8.00-10.00 a.m. on VLX4 4897 Kc, VLW9 9610 10.15 a.m.-8.15 p.m. Monday to Friday, 10.00 a.m.-8 p.m. Saturday, and 10.15 a.m.-7.15 p.m Sunday, on VLX9 9610, VLW11 11,840; 8.20 p.m 1.30 a.m. Monday to Friday, 8.15 p.m.-2.00 a.m on Saturday, and 7.30 p.m-1.30 a.m. on Sunday on VLX6 6130 and VLW9 9610 Kc.

## Radio Japan

THE transmissions from Radio Japan, in Tokyo have undergone some frequency and transmission time changes and the present operating schedule is as follows:

1.30-2.30 a.m., 11705, 15325 Kc., to India, Pakistan, Ceylon.
3.30-4.30 a.m., 11705, 15325 Kc., Near East.
9.00-10.00 a.m., 17825, 15325 Kc., Eastern North America.
3.00-4.00 p.m., 17795, 15325 Kc., Western North America.
4.30-6.30 p.m., 17795, 15225 Kc., Europe and U.S.S.R.
5.00-6.00 p.m., 17825, 15235 Kc., Hawaii.
7.00-8.00 p.m., 17825, 15235 Kc., Australia New Zealand.
9.30-10.30 p.m., 17825, 15225 Kc., Philippines Indonesia.
12.00-1.00 a.m., 11705, 15235 Kc., Burma, Indo China, Thailand.
7.00-8.00 p.m., 11705, 9225 Kc., South America

Four transmitters are used by Radio Japan, two of 100,000 watts and two of 50,000 watts. The higher power is used in all cases except when two transmissions are programmed at the one time. In the case of the Australian transmission, only 50 Kw. is used, the greater power being used in the service to South America. Likewise in the transmission to Hawaii, 50 Kw. is released, while the higher power is beamed in the service to Europe.

## FLASHES FROM EVERYWHERE

**NEW GUINEA** transmissions from Port by, which is using the frequency of 6130 K same as the new VLX6 Perth, has been lis Radio Australia. The station relays the br band station 9PA, 1250 Kc . The full sched Mon.-Fri., 4.00-10.45 p.m.

Sunday, Monday, Tuesday, Wednesday, day, 6.45 a.m.-2.45 p.m.

Friday, 6.35-9.30 a.m.; Saturday 7.45 p.m.

Saturday, noon-1.00 p.m.; Sunday, 4.00 10.00 p.m. The station is using the callsign on 6130 Kc.

**WEST INDIAN** stations in the West Broadcasting Service have been noted in Zealand with an early schedule on the d the Test cricket broadcasts of the Engla West Indies matches being played in the Kingdom. The station is using 4760 Kc., o at 8 p.m. in a local program and at 8.2 took a relay from London of the B.B.C. commentary. The dates of the last Test in E is 22 to 27 August.

**ECUADORIAN** station HC1RP, on 501 has been heard by Stuart Morris opening tra sion at 8.45 p.m. and at 9 p.m. giving its fication, following classical recordings. Th gram after 9 p.m. consists of a devotiona vice with news in Spanish at 9.0 p.m.

**BRUSSELS,** in Belgium, is the site of a Fair to be opened next April, and to giv fair world-wide publicity a special progra English is being broadcast by the Brussels each day except Monday. The transmissi North America is 10.30 to 11.00 a.m. on 178 and on the usual Brussels frequencies of and 9660, 15335, while the OTC, Leopol transmitter is using the 9655 Kc. transmitter program from the Leopoldville relay station at times use the 17850 Kc. The program peated for other areas of the world on bo Brussels and Leopoldville transmitters.

**SOUTH AFRICAN** Broadcasting Corporati announced that all shortwave transmission now carried on the 20,000-watt paradyse mitters. The old lower-powered station at nesburg has been closed down, and so the of signals from the South African area in th is being gradually overcome. Reports from America state that the transmissions on a the afternoons, the 9523 Kc. has been not 3.40 p.m. and the program on 7229 Kc. has heard at 3.30 p.m., and the African servic heard at the same hour on 7275 Kc.

**BELGRADE** has made some changes in the ish broadcasts, reports Cyril Anderson, of W Australia, who states the news is now bro t 4.15 a.m. on 6150, 7200 and 9505 Kc.

**TAIWAN** signals which have been hea BED4 11815 Kc., and BED57, 15435 Kc., are n the English service, and have been heard 9.30 p.m. at good strength, though the ome jamming on the channels at times.

This is a new transmission to Japan, nd Indonesia.

**GUATAMALAN** station, Radio Nacion hortly to increase power to 20,000 watts o frequencies now in operation for its norn .m.-3 p.m. schedule. The station uses 640, 180 and 9760 Kc. and is regularly heard i area on the latter two frequencies.

**ADEN** transmissions on 7170 Kc. have bee imed and the station signs off one half-hour t 4 a.m., with God Save The Queen.

**MONTE CARLO RADIO,** broadcasting Monaco, has made a frequency move and is using three frequencies, 6035 Kc. for the transmission; 7132 Kc. up to 7 p.m. from si p.m., and also after 5.15 a.m.; and on 973 for the period, 7 p.m.-5 a.m.

**SYRIAN** signals from Damascus have been n New Zealand on 7130 Kc. in English 4.15 a.m. to 5.30 a.m. News is broadca 4.15 a.m. and then a commentary, music lighter type is carried from 4.30 to 5.30 a.m

**ARGENTINA** has been operating on 9690 a session in English from 2.00 to 2.50 p.m. using the L.R.A. transmitter. The old sloga Radio del Estado has been replaced by Nacional.

**CHILEAN** station CE960, broadcasting from tiago, has been heard with a new slogan, Presidente Balmacedo, for its operations on Kc. The signal shows an improvement in area, and suggests a power increase.

**MANILA** station of the Far East Broadca Company, using 21515 Kc., has been assigned call DZI3. The station uses 1,500 watts and been testing for several weeks and is well rec in this area and in Europe. Radio activit the Philippines has increased in recent weeks Manila now has some 19 stations on broad many of which have shortwave relays.

# HE HAM BANDS WITH BILL MOORE

memory of their comrades who fell in World War II radio amateurs throughout Australia ch August join in the Remembrance Day Contest. It is the best supported of all events conducted by the WIA.

JALLY since 1948 the Wireless Institute Australia has conducted the Remembrance ontest in memory of amateurs who made reme sacrifice in World War II.

held on the weekend nearest the anni- of VP Day, August 15, and engraved on ohy are the names and call-signs of radio s who fell.

Th trophy is awarded to the Division of the whose six leading stations amass the scores.

eurs throughout the Commonwealth and ies are invited to participate by the n the contest. It provides an opportunity with your interstate ex-service friends and articipation will assist your division to win veted trophy — final scores are fixed n allowance for the degree of activity in ntest in each State.

rules for the contest are as follow:—

eurs in each call area (this includes those stralian Mandated Territories and Austra- ntarctica) will endeavour to contact ama- n other call areas (VK1 and VK2 are con- to be one call area).

— August 17 and 18, 1957. The con- mmences at 1800 hours EAST, August 17. ncludes at 1759 hours EAST, August 18.

eriod of 15 minutes' silence will be ob- by all stations on August 17, immediately o the start of the contest.

ng this period an appropriate broadcast e made from VK3WIA and relayed by nal stations.

1: There shall be four main sections to ontest—(a) Transmitting phone; (b) Trans- ; CW; (c) Transmitting Open; (d) Receiv- ione and CW.

All Australian amateurs may enter for the t whether they are fixed, portable or but only members of the WIA are for awards.

All amateur frequency bands may be used. cross-band operating is permitted.

Amateurs may enter for one of the above is listed in Rule 1. An open log will be ontaining both phone and CW contacts.

Only one contact per station per band is d and arranging schedules for contacts on bands is not permitted.

Only one licensed amateur is permitted to e any one station under the owner's call- Should two or more operate any particu- ation, each will be considered a contestant nust submit a separate log under his own gn.

ntestants operating stations other than their shall be referred to, for the purposes of rules, as "substitute operators."

ir operating procedure will be as follows:—

ne Contacts: Substitute operators will call Remembrance Day," followed by the call of the station they are operating and the "log," followed by their own call sign.

Contacts: Substitute operators will call D de," followed by the group call-sign ising the call-sign of the station they are ting, an oblique stroke, and their own gn.

ntestants receiving signals from a substitute tor will qualify for points by recording the of the substitute operator only.

Entrants must operate within the terms of licences.

Cyphers.—Before points may be claimed for ontact, serial numbers must be exchanged and acknowledged. The serial number of five or six figures is in accordance with usual arrangement for VK contests.

9: Entries must be set out in the following order.—Date and time, band, type of emission, call-sign worked, number sent, number received, points claimed.

One side of the paper only to be used and entries must be postmarked not later than September 7, 1957, and addressed to the Federal Contest Committee, W.I.A., Box 1234 K., G.P.O., Adelaide, South Australia.

10. Scoring will be based on the table shown.

Contacts from VKO to any State, 6 points. Any State to VKO, 6 points. VK2 covers VK1 also.

Contacts from VK2 to VK3, 1 point; VK4, 2 points; VK5, 3 points; VK6, 5; VK7, 4; VK9, 6.

VK3 to VK2, 1; VK4, 3; VK5, 2; VK6, 5, VK7. 4; VK9, 6.

VK4 to VK2, 1; VK3, 2; VK5, 3; VK6, 6; VK7, 5; VK9, 4.

VK5 to VK2, 2; VK3, 1; VK4, 3; VK6, 5; VK7, 4; VK9, 6.

VK6 to VK2, 1; VK3, 2; VK4, 4; VK5, 3; VK7, 5; VK9, 6.

VK7 to VK2, 2; VK3, 1; VK4, 4; VK5, 3; VK6, 5; VK9, 6.

VK9 to VK2, 1; VK3, 2; VK4, 3; VK5, 4; VK6, 5; VK7, 6.

11. All logs shall be set out as shown and, in addition, will carry a front sheet showing the following information:

Name, section entered, address, callsign, score claimed and a signed declaration stating the rules and spirit of the contest have been observed.

12. The right is reserved to disqualify any entrant who during the contest has not observed regulations or who has consistently departed from the accepted code of operating ethics.

13. The ruling of the Federal Contest Committee of the W.I.A. will be final, no dispute will be entered into.

14. Awards: Certificates will be awarded to the winners of the phone C.W., open and receiving sections in each call area (Northern Territory will count as a separate call area). There will be no outright winner for Australia. Further certificates may be awarded at the discretion of the contest committee.

The State to which the perpetual trophy will be awarded to shall be determined in the following way:

To the average of the top six logs shall be added a bonus, arrived at by multiplying this average by the ratio of valid logs submitted by that State to the total of amateur licensees in the division at the time of the contest. Logs acceptable for the multiplier shall show at least five valid contacts in the contest.

Receiving Contest: Open to all S.W. listeners in Australian stations. Points will be scored in a similar manner to the transmitting contest and logs must show the callsign of the station heard and the serial number sent by it, also the call sign of the station being called. It is not sufficient to log a station calling C.Q.

A station heard may be logged only once for each band.

Awards: Certificates will be awarded to the highest scorer in each call area. Further certificates may be awarded.

Logs should be submitted showing information in the following order: Date and Time, E.A.S.T. band, callsign heard, number sent, station called points claimed.

## Queensland Convention

THE Queensland Division of the W.I.A. held their 3rd annual convention over the Queen's Birthday weekend, June 15th, 16th and 17th. The venue, on the "gold coast" of the State, at Palm Beach.

Many amateurs, their wives, children and friends attended, and all helped to make the event a success.

Although rain fell it did not seriously interfere with the many events.

The results of the various competitions were as follows:

7 Mc/s Scramble, 1st, John Pickles, VK4FP. All Band Scramble, 1st, Bill Hall, VK2XT. First Hidden 144 Mc/s Transmitter Search, 1st, Jack Ross, VK4JO.

Second Hidden 144 Mc/s Transmitter Search, 1st, John Pickles, VK4FP.

144 Mc/s Blindfold Hunt, 1st, Jack Ross, VK4JO.

7 Mc/s "Bob Campbell" Memorial Contest, 1st, Bill Hall, VK2XT.

Start working on that mobile and portable gear now and you will really be ready for next year's event at the same location.

The above notes were contributed by John, VK4ZAG.

## New N.S.W. Council

THE Council for 1957-1958 of the N.S.W. Division of the W.I.A. sees many new faces, although most of the members have been active in other phases of W.I.A. activity.

The new president of the division is Perc. Heally, VK2APQ, well known as chairman of the V.H.F. and TV section.

Perc has been very active for a number of years, not only on the V.H.F.'s but on H.F. bands, too. Known personally to many amateurs, and with a wealth of Institute experience, he is certain to guide activity along lines most profitable to the movement.

Senior vice-president is Bob Godsall, VK2ARG. also a very active amateur on H.F. and V.H.F. bands. He recently journeyed west to VK2ACU, at Coonamble, with portable 144 Mc equipment and opened another country section. He worked over 180 miles.

Bob used to watch the 144 Mc/s band up in the air, but these days travels on the water and can be heard working portable from his cruiser on Broken Bay. Bob will also manage Public Relations for the division.

The second vice-president is Roy Hart, VK2HO, the oldtimer of the council who first operated in the late twenties.

Recently returned from the Civil Defence School t Macedon, Roy is an authority on C.D. and takes over the position of C.D. Net Co-ordinator.

Another duty is councillor in charge of VK2WI, Dural. He has, through the year, operated on all bands, with special interest in V.H.F. affairs. Roy, more fortunate than most of us, has plenty of spare time.

Max Sobels, VK2OT, needs no introduction. He has operated from a number of Q.T.H.'s in N.S.W. and was active in the Hunter branch of the W.I.A. In recent years he has been explaining the mysteries of television to students at the North Sydney Technical College. Max has lectured to the division on a number of occasions and will take charge of educational and lecture arrangements.

Norm Beard, VK2ALJ, is also a lecturer in TV at the same college and is active on all bands, with some emphasis on the V.H.F.'s and V.H.F. and TV sections' articities.

He will assist in secretarial duties on the council.

In charge of secretarial duties is Keith Woodward, XK2ZAU, who has made a name for himself on the V.H.F.s since the advent of the Z. calls.

The seventh member of the council has yet to be elected.

The new council have many ideas they wish to put into practice, with special emphasis on technical lectures at meetings and the reduction of unnecessary business debates. Amateurs will wish them success in a task that will take so much of their time and efforts.

Officers elected at the annual meeting of N.S.W. V.H.F. and TV section of the W.I.A., held on July 5th, were as follows: Chairman, Bob Winch, VK20A; Vice-chairman, Dave Andrews, VK2AWZ; Secretary, Jim Cuming, VK2ZBD; Councillors, Phil James, VK2ER; John Miller, VK2ANF; and Chas Fryar, VK2NP.

## AMATEURS TO HELP IN OPERATION SMOKE PUFF

IATEURS in certain sections of the U.S. will be able to assist in yet another scientific re, that of operation "Smoke Puff." Man now be attempting to establish an artificial cting layer by firing a rocket into the strato- re and releasing ionised gas.

st year a rocket emitting nitric oxide gas fired into the E. layer, some 70 miles up observations recorded indicated that a reflect- cloud had been formed.

is hoped that several ionisation-producing ets will be fired each year and amateur co- ation in observations will commence in July e lifetime of the cloud as a reflecting medium probably be from 10 to 20 minutes, and dur- that period an artificial patch of short skip uced. Amateurs could possibly establish acts or make observations during the time. the circle in which useful data can be collected pproximately 1,300 miles in diameter.

nateurs participating will be advised of each ching and whether the test was considered satisfactory. Rockets will be fired at various tim of the day.

It is anticipated that observations of signals o he 14, 21, 28, 50 and 144 Mc/s bands may pr ide useful information on the clouds' behaviou

## Frequency Allocations

AN important recommendation recorded by th F.C.C. in the U.S. is to the effect that n changes be made in service frequency allocation of the Atlantic City conference from 10 Kc/s t 10,500 Mc/s. This suggestion would form th basis for action at the 1959 Berne I.T.U. conference. Under this arrangement it means that amateur bands over there would remain as at present unless the recommendation is countered by other U.S. Government, military or industry requirements.

The excellent support the movement receives from the U.S. Government and delegations to I.T.U. conferences must indirectly assist the hobby in other countries, although actual voting is on a national basis.

# *Bargains in Scores, at* SURPLUS STORE

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### FOUR DOORS FROM VICTORIA STREET

The place for ex-Army and ex-Air Force articles, in excellent condition and astonishingly low prices.

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***Mail Orders are carefully packed***

**Shooters! Sightseers!**
**TELESCOPES, GOING CHEAP**

20 magnification, pigskin carrying case, pocket size, very handy, **£5/5/-.** 30 mag., with tripod, **£10/19/6.** 50 mag., prismatic telescopes, on tripod, **£17/17/-**

**FLYING BOOTS**

Fine thing for Motor Cyclists, Tractor Drivers, etc. Wool-lined.
**£5/19/6 a pair.**

**Universal Flexible Shaft Chuck**

¼ inch; 44 in. long. .. **PRICE £4/15/-** Grinding and engraving burrs, pkt. of 6, **2/-.** Polishing brushes, **6d each.** Hobbyists, die-makers, engineers, garagemen, plastic workers, these are useful.

**WEATHERPROOF FLYING SUITS**

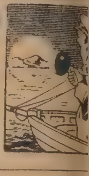
(Brand New. Zippered.) Ideal for Motor Cyclists, Tractor Drivers, Boat Owners, etc. In heavy proofed canvas, with zippers on side, leg and sleeves.

When ordering, please state height and chest measurement. **PRICE 87/6.**

**LEATHER FLYING HELMETS**

| | |
|---|---|
| Ex-R.A.F. .. .. .. | **PRICE 50/- EACH** |
| Intercommunication Tubes .. .. | **50/-** |
| MK7 Goggles .. .. .. .. .. .. | **25/- pair** |
| Polaroid Goggles .. .. .. .. .. | **48/6** |
| MK8 Goggles .. .. .. .. .. .. | **48/6** |

**SEALED BEAM SPOTLIGHT**

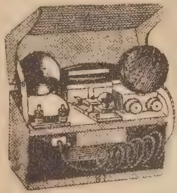


6-volt. The real thing for Cars, Shooting, Boats, etc.
**PRICE £4/4/-**
ALSO 12-VOLT.
**PRICE £4/8/6**

## Special Offer!

Magnifying glasses, 8 mags., **8/6**
mags., **12/6.** New Headphones for
stal sets, **32/6** pair. Tapped T
formers, 6, 12, 18 and 24 volts, 3 a
**45/-.** Tweezers, **5/6.** Watchmakers'
glasses, **6/6;** extra strong, 10 mag.,
Set of five Watchmakers' Screwdri
**13/9.** 12 volt, 500 watt Generators.
Metric open-end Spanner Sets (7 s
ners), **29/6.** 24 volt, 1500 watt G
ators, **£12/10/-.** 200 am. Genera
ideal for welding, **£37/10/-.** Small
Ball Bearing Stepdown Gear Box, 3

## TELEPHONES: YOU'VE A SPLENDID CHOICE HERE!



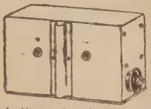
**DON v PHONES.** A compact unit. Can be used either as a wall or desk phone. It has a range of many miles.
**PRICE: £6/10/- EACH.**

**DESK TYPE.** These are powered by two standard 1½-volt X cells. **£8/10/- EACH. OLNEY PHONES.** Two 1.5 X cells. Range over many miles. Entirely self-contained unit. **PRICE £6/10/- EACH. F. PHONES.** Also self-contained. Two 1.5 X cells. Range, 20 miles. **PRICE (WITH BATTERIES): £8/10/- EACH.** Hand generators, will fit these phones, **12/6 each. AND HERE'S ANOTHER BARGAIN:** Q 22 Twin Wire, 100 yds. on steel drum. Waterproofed for outdoor use. **PRICE, PER REEL, 27/6.**

**ENGINEERS' VERNIER GAUG**

Marked in inches and millimete
**Don't miss this at 14/6**—it's one
of the box."

**COMPLETE BATTERY CHARGER**



Fitted with Brand New English Selenium Rectifier
Works off 230v Household Supply.

**Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Charger combined. Charges 4 amps. £7/15/-; 6 volt 2 amp Chargers, complete, £5/15/-; 12 volt 3 amp, £6/15/-; 6 and 12 volt, combined 6 amp, £9/15/-.**

**Not Secondhand.**
**BRAND NEW.**
**ENGLISH G.E.C. RECTIFIERS.**

**Make yourself a Battery Charger.**

| | |
|---|---|
| 12v 2 amp .. .. | 32/6 |
| 6v 5 amp .. .. | 50/- |
| 12v 3 amp .. .. | 45/- |
| 6v 2 amp .. .. | 24/6 |
| 6v 4 amp .. .. | 45/- |
| 12v 5 amp .. .. | 79/6 |

**Transformers to suit these, 2 or 3 amps, 45/-; 4 or 5 amps, 55/-.**

**HERE'S AN ALL-PURPOSE CAP FOR YOU**

Great wearing for motor bikes or when you want to ski.

**GIVE-AWAY PRICE: ONLY 12/6.**

**LISTEN TO YOUR ENGINE KNOCKS**
**MECHANICS' STETHOSCOPES**

Very cheap at this **PRICE: 35/-.**

**AIRCRAFT MOTORS**

24 VOLTS, COMPLETE WITH 400 gl. P.H. PUMP.

Ideal for pumping any kind of liquid. Has many uses on any farm. Will work off any 32-volt lighting plant.

**PRICE: £12/10/-.**

**SPECIAL DISPOSALS METER OFFER**
**All Brand New. British Made.**

| | |
|---|---|
| 0-1 Milliamp Meters, 2½in dial .. | |
| 0-30 amps DC 2in dial .. .. .. .. | 27/6 |
| 0-3 amp Meters, AC-DC, 2¼in dial .. | 45/- |
| 0-50 Milliamps, 2½in dial .. .. .. .. | 27/6 |
| 50-0-50 amps .. | 50/- |
| 0-50 amps AC-DC .. .. .. .. | 4 |
| 0-40 amps AC-DC .. .. .. .. | 4 |
| 0-14 amps AC-DC 4½in .. .. .. | 5 |
| 0-200 amps DC .. .. .. .. | £4/1 |
| 20-0-20 amps DC .. .. .. .. | 3 |
| 0-50 amps AC-DC 3½in .. .. .. | 7 |
| 0-60 amps AC-DC 3¾in .. .. .. | 7 |
| 0-80 amps AC-DC 3½in .. .. .. | 7 |
| 0-1 amp DC 2½in .. .. .. .. | 4 |
| 0-200 amps AC-DC 3½in .. | £4/1 |
| 0-50 amp AC-DC 2½in .. .. .. | 4 |
| 0-150 milliamps DC 2½in .. .. .. | 4 |
| 0-20 volts DC 2½in .. .. .. .. | 2 |
| 0-5 milliamps 2½in .. .. .. .. | 4 |
| 0-30 volts Weston .. .. .. .. | 3 |
| 0-40 volts AC-DC .. .. .. .. | 4 |

## 50KW for Yanks

recently rejected an application for a wer limit for the 144Mc band for of experimenting with scatter propa- e Commission stated they appreciated of amateur contributions to the sci- communications, but believe that the crease would not significantly increase d for experimentation in the scatter field.

of this winter's 3.5 Mc/s operation he absence of the usual VK gang Man's band. A number of amateurs ked on the fact, even the ZLs are erous as usual. Main activity on the to be among VHF fraternity lining tance contacts on the 144 Mc/s band. they will migrate back when the on of the HF bands is on the wane.

xecutive has been notified by the Boy ciation in England that during the Boy lee Jamboree (August 1 to 12) at Sut- Sutton Coalfield, an Amateur Radio er the cal of GB3SP will be in opera-

cilities have been granted by the British General including permission to radiate Bulletin." This news service will be various frequencies "on the hour" .00 hrs. and 22.00 hrs. G.M.T.

tation will be carrying out the normal ctivities at other times, the scouts are rward to making contacts with DX They hope by means of special radia- ed to suit conditions to reach Australia. ted are asked to listen for the call bands from 3.5 to 30 megs.

## DX record

rld's DX record on 50 Mc/s received ber of jolts during the first six months ear. To date, however, no contact led the 12,000 miles of the JA6FR to ct.

of JAs have worked into South Amer- ontacts over 10,000 miles, even across t of that continent when JA1GP-CX2RE VKs and ZLs are missing a lot of as they are not permitted to operate c/s.

he best propagation conditions record- band were observed, LU7AT reported s for 14 days on end in April. heard included YV, XE, JA, CO, OA, VE, PZ, PJ2.

this year a number of American sta- e contacted three continents on 50 Africa, Asia, South America and the 50 Mc/s operation in Europe will be is creating great interest.

December, CT1 Portugal, CT2 Azores, leira, stations will be allowed the use nd 50.0 to 52.0 Mc/s and it is antici- t Swedish stations will soon be oper- the band. Oceania will then be the inent not operating on the band.

Ac/s WAC is still a possibility, however, can nationals on some of the Pacific pen on the band.

end of June, the RSGB conducted a 70 ) Mc crossband contest and the Fs will to work across the Atlantic on 72 Mc/s. xt year, with added interest on 50 Mc/s, GY participation, should see even more g contacts made.

## hird party traffic

EURS in this country have often been rassed by overseas amateurs requesting relay messages to someone in Austra- lthough the habit is not nearly as pre- s was the case in the period immedi- stwar, when so many amateurs returned still occurs.

amateurs can handle third party mes- th amateurs in a number of countries in nd South America and Liberia in Africa. e messages must be of a personal nature e that would not be normally carried by ial communication facilities.

sale international handling of traffic by s was originally banned in the articles of lrid (1932) conference.

exact wording in the 1947 Atlantic City gulations is as follows: "It is absolutely n for amateur stations to be used for trans- international communications on behalf of rties," with an added rider that the pro- can be modified by special message hand- ties between countries listed.

y speaking, we cannot handle any in- on for or on behalf of third party, even person is another amateur.

have read in the newspapers of how an had arranged the shipment of a rare that fact, possibly, has news value for by. It is, however, strictly illegal and horities could take action in such cases.

## Signals from VR3

on Fanning and Christmas Islands have n taking a beating from the usual mass als. Some of the big DX men have been laying down instructions on how the should behave.

of them in quick succession were heard tact with the VR3s complaining about the behaviour on the frequency. The inter- point was that all three had contacted the before.

y, while these chaps are still rare, one would be enough; it would at least keep mber of stations on the frequency to a m.

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# AUDIO OUTPUT TRANSFORMERS

**Listed below are types normally in stock and suitable for HI-FI or P.A. requirements.**

| Type No. | Watts | Primary Impedance | Secondary Impedance | Primary will match | Class | Retail Price inc. s./tax 25 pc |
|---|---|---|---|---|---|---|
| **HIGH FIDELITY (plus minus 1db 30-15,000 c/s)** | | | | | | |
| 763 | 15 | 5000-3000 ohms P.P | 15, 12.5, 8, 3.7 and 2 ohms | P.P. 2A3s or 6AS/s | A or ABI | 6/17/3 |
| 896 | 15 | 10,000-8000 ohms. P.P. | 15, 12.5, 8, 3.7 and 2 ohms | P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc. | A or ABI | 6/17/3 |
| 897 | 15 | 10,000-8.000 ohms. P.P. | 500, 250, 166 125 and 100 ohms | P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc. | A or ABI | 6/17/3 |
| **SPECIAL HIGH FIDELITY (plus minus ½ db 20-40,000 c/s)** | | | | | | |
| 872 | 12 | 10,000 ohms P.P | 3.7 or 15 ohms | P.P. 6L6s, 807s, KT66s, etc. | A (triodes) | 8/8/7 |
| **SPECIAL HIGH FIDELITY (plus minus 1db 10-50,000 c/s)** | | | | | | |
| 2505-8 | 12 | 6000 ohms C.T. | (Designed especially for Mullard 5/10 Amplifier) | | | 8/18/5 |
| **ULTRA LINEAR plus minus 1db 10-50,000 c/s)** | | | | | | |
| 949 | 12 | 8000 ohms | 2, 8 12.5 and 15 ohms | 6V6, 6BW6, KT61, EL84, etc. | See R & H. Jan., May, Aug. 1955. | 9/7/11 |
| **MEDIUM FIDELITY (plus minus 2db 50-12,000 c/s)** | | | | | | |
| 809 | 15 | 500 ohms | 15, 12.5, 8 3.7 and 2 ohms | Line to voice coil | | 4/9/9 |
| 914 | 15 | 5000-3000 ohms. P.P. | 500, 250, 166, 125 and 100 ohms | P.P. 2A3s, 6A3s, 6AS7s, etc. | A or ABI | 6/4/- |
| 915 | 15 | 5000-3000 ohms P.P. | 15, 12.5, 8 3.7 and 2 ohms | P.P. 2A3s, 6A3s, 6AS7s, etc. | A or ABI | 6/4/- |
| 917 | 15 | 10,000-8000 ohms P.P. | 500, 250, 166, 125 and 100 ohms | P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc. | A or ABI | 6/4/- |
| 918 | 15 | 10,000-8000 ohms P.P. | 15, 12.5, 8 3.7 and 2 ohms | P.P. 6V6s, 6BW6s, 6M5s, KT66s, etc. | A or ABI | 6/4/- |
| 922 | 25 | 8000 ohms | 500, 250, 166, 125 and 100 ohms | P.P. 6L6s, 807s, KT66s, etc. | ABI | 7/7/9 |
| 891 | 35 | 6600 P.P. ohms | 500, 250, 166 125, 100 and 83 ohms | P.P. 6L6s, 807s, KT66s, etc. | ABI | 8/3/6 |
| 928 | 5 | 7000-5000 ohms S.E. | 12.5, 8, 3.7 and 2 ohms | 6V6s, 6BW6s, KT61s, 6M5s, etc. | | 3/7/- |

*Queensland readers only invited to write for comprehensive data sheet.*

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BRANCHES THROUGHOUT QUEENSLAND

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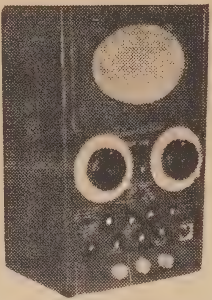

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12 valve. Converted to 240v. A.C. Thoroughly Tested Re-aligned Latest Ovaltone Permag Speaker

**£34/17/6**

## Type T3 press to talk CARBON MICROPHONES

NEW

**12/6 ea.**

## NEW 24V MOTORS

Series wound Hi-Speed miniature 12,000 RPM .. £2/10/-

Shunt wound with gear box 2 speed 5 and 25 RPM .. £2/10/-

## 12 VOLT GENERATORS

New C.A.V. 80 amp. Generators. Ideal for lighting or fast charges.

**£10/10/-**

Throat Mikes New .. .. .. .. .. .. .. 3/6

12V. 420 watt Prefocus Globes .. .. 7/6

## NEW C.R.O. TUBES

All tested on TV picture

3BP1 with shield and socket .. ..£3/17/6

VCR 97 .. .. .. .. .. .. .. .. .. £2/17/6

ACR2X & Shield .. .. .. .. .. £3/0/0

CV 112 White 5" .. .. .. £3/10/0

CV 254 9in. Blue Screen, Magnetic Deflection & Focus

**£4/10/-**

Every tube capable of perfect picture Fast persistence and simple construction using standard components

## NEW 2½" MOVING COIL R. F. METERS

350. MA and 1. Amp. Can be shunted for other ranges

**7/6 ea.**

POSTAGE 1/6

Used units as above. Good order

**4/6 ea.**

POSTAGE 1/6

AR8-AT5—COMPLETE STATION

## AIR TESTED

Transmitter-Receiver, Aerial Coupler Cables, Plugs, Phones, Mike.

1 Crystal to desired Frequency

24V Power Supply & Circuits of 2 units

GUARANTEED IN PERFECT ORDER

**£62/10/-** Other voltages available

## NEW B.S.R. FP10 GRAMO MOTORS

240 or 110

FOR THAT TAPE RECORDER

**£1/19/6** POSTAGE 2/6

## NEW VALVES

| | | | |
|---|---|---|---|
| 217C | 10/- | 6E5 | 12/6 |
| 12C8 | 12/6 | 12K8 | 12/6 |
| 6J8 | 17/6 | VT502 | 12/6 |
| VT501 | 12/6 | 7A6 | 7/6 |
| EBC33 | 12/6 | AV11 | 3/9 |
| 1H6 | 7/6 | 832A | £3/0/0 |
| 6L6 | 20/- | 6K7 | 7/6 |
| 1C6 | 12/6 | 12SJ7 | 12/6 |
| 1G4 | 12/6 | 12SK7 | 12/6 |
| 1D4 | 12/6 | 12SL7 | 12/6 |
| 1J6 | 12/6 | 39/44 | 10/0 |
| 1K4 | 12/6 | 46 | 12/6 |
| 1K6 | 12/6 | 47 | 12/6 |
| 1LH4 | 12/6 | 78 | 12/6 |
| 1P5 | 5/- | 828 | £2/10/0 |
| 6A6 | 12/6 | 843 | £1/10/0 |
| 3A4 | 15/- | 957 | 6/6 |
| 3B7 | 10/- | 1625 | £1/0/0 |
| 3D6 | 10/- | 1629 | 10/0 |
| 6AG5 | 9/6 | 4307A | 10/0 |
| 6AM5 | 15/6 | 1619 | £1/0/0 |
| 6AM6 | 17/6 | 2050 | £1/0/0 |
| 6H6 | 7/6 | 9001 | 8/6 |
| 6J6 | 15/- | 9003 | 12/6 |
| 6J7G | 9/6 | 9004 | 8/6 |
| 6N7 | 10/- | RK75 | 10/0 |
| 6SK7 | 12/6 | VR75/30 | 15/- |
| 6SL7 | 12/6 | RK48A | £3/0/0 |
| 10 | 15/- | 954 | 7/6 |
| 12A6 | 12/6 | VR105/30 | 15/- |
| 2A3 | £1/0/0 | 1C7 | 4/6 |
| KTW62/6U7 | 7/6 | 1T4 | 12/6 |
| 1M5 | 7/6 | 1A5 | 7/6 |
| 1D5 | 7/6 | 7193 | 3/6 |
| CV6 | 3/6 | 829B | £3/0/0 |
| 6F6 | 12/6 | 6G8 | 15/- |
| VR65A/SP41 | 2/6 | 6B8 | 12/6 |
| KT66 | 27/6 | 807 | £1/0/0 |
| 806 | £3/10/0 | EL3NG | 12/6 |
| 6V6 | 12/6 | 83 | 10/0 |
| 1K7 | 7/6 | EMI | 12/6 |
| 6X5 | 10/- | 866A | 15/- |
| 1Q5 | 6/6 | 6AC7 | 3/6 |
| 811 | 1£ | EF50 | 3/6 |
| X61M | 17/6 | 100TH | £2/5/0 |

## INVERTERS

6V. 12V. 24V. 32V. DC to 240

60 Watt to operate Radio, Flu

Lights, Shavers, etc.

**£8/17/6**

## NEW TRANSFORM

FERGUSON

### VIBRATOR TRANSFORM

150 x 150 40MA. 6V. .. .. .. .. £1

300 x 300 100 6V. .. .. .. .. £1

325 x 325 125 12V. .. .. .. .. £3

### INVERTER TRANSFORM

6V. 240V. 40 watt .. .. .. .. £

12V. 240V. 60 watt .. .. .. .. £

32V. 240V. 60 watt .. .. .. .. £

### C.R.O. TRANSFORME

350 x 350 extended to 1

6.3V. 6.3V. 215V. 4V. £

POSTAGE N.S.W. 5/- INTERSTA

## New A.R.B. Receive

8 Valve

4 Band 195 KC. to 9.025 Megs.

24V. D.C. Operation .. .. .. £22

Converted for 240V. A.C. .. £33

## RELAYS

6v. 3Ple Miniature .. .. ..

1700 SPDT .. .. .. .. ..

1300 SPDT .. .. .. .. .. ..

500 x 500 SPDT .. .. .. ..

12 volts DPDT 5 amp .. .. £

24 volts DPDT .. .. .. ..

8-16 volt DPDT .. .. .. ..

11 volt AC .. .. .. .. .. £

Hi-speed Polarised relay £2

400 ohm .. .. .. .. .. ..

1300 ohm DPDT .. .. .. ..

½in Square Section DURAL

ING UP TO 12ft lengths 1/- p

Hi-lo Phono Transformers ..

Spirit Level Bubbles, mounted

Canadian Signal Lamps .. ..

Hi-voltage Lead-Thru Insul

.. .. .. .. 1/6 each, 15/-

Hydrometers, Battery Testers

Torches 2-cell Focusing .. ..

Multi -Strand 4 core Cable,

Yard, 1/-; 100 yards £2/

Tx Var. Condensers, 300 pf £

100 pf £

60 pf with Vernier .. .. £

30 pf

★★★★★★★★★

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PHONE
LA 3845

VICTORIA R'D. MARRICKVILLE. SYDNEY, N·S·W

TRAM AT DOOR. STOP 42

COLLAROY ST., COLLAROY—XW5956

## A.W.A. .3B
## TRANSMITTERS

12 Volt operation
9 megs. 10 watt output
tested complete with 1
Crystal
**£29/10/-**

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Standard P.M.G. Type
Magneto Phones tested in perfect order.
**£6/10/-**

## ECORDING TAPE

& Scotch. Hi. Coercivity, Excellent Condition. Ex ABC.

| | | | |
|---|---|---|---|
| 1200 ft. Spools | £1 | 8 | 6 |
| 600 ft. Spools | | 18 | 6 |
| 3250 ft. Platters | £2 | 10 | 0 |

## V ALPHA SWITCHES

| | |
|---|---|
| D.F.D.T. | 3/9 |
| D.P.S.T. | 3/3 |

POSTAGE 6d

## NEW No. 22

2 to 8 megs as above. Converted to Crystal Control. Power increased to 20 watts. Includes Plugs and Cables Mike, Speaker, Circuit, 2 Crystals to wanted frequency conforms to PMG requirements for small ships and other services. **£49/17/6**

## WANTED

**Communication Receivers Test equipment, P.A. gear. Large or small surplus stock. Best prices. Call, write or phone any time.**

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| | | | |
|---|---|---|---|
| 1UF 600V | 6/6 | 5UF 2.5V | 6/6 |
| 4UF 750V | 12/6 | 5UF 400V | 6/6 |

10MFS 500 7.5UF 330V AC 10/-

## NEW P.A. AMPLIFIERS

10 WATT OUTPUT

12V. D.C. powered. 5 valve input for crystal mike & P.U. Fader Controls & Tone Control Standard Octal valves. **£14/17/6**

## Telephone Equipment

| | |
|---|---|
| Hand sets | £1/9/6 |
| Mike inserts | 3/6 |
| Head and breast sets | 17/6 |
| Hand sets with pressel-switch | £1/15/- |
| Hand generators & bell | 9/6 |
| Adjustable buzzers | 7/6 |

Miniature telephone units to suit Handsets or H & B, 10/-

## NEW SMITH AIRCRAFT CLOCKS

8-day movement. Cost Govt. £28
$2\frac{1}{4}$" £4/15/0
$2\frac{3}{4}$" with sweep hand £5/15/0

## New Coils and Intermediates Standard or Miniature to suit all valves

| | |
|---|---|
| Coils B/C 455 KC | 9/6 |
| Coils S/W 455 KC | 9/6 |
| Inters | 11/6 |
| Loop aerial coils | 9/6 |
| Slug tuned H.F. coils suit 44 meg. | 4/6 |

## GENEMOTORS

| Input | Output | | | | | |
|---|---|---|---|---|---|---|
| 24V | 250V | 100MA | | £1 | 0 | 0 |
| 24V | 550V | 375MA | | £2 | 0 | 0 |
| 24V | 250V | 60MA | | £1 | 5 | 0 |
| 12V | 500V | 350MA | | £8 | 10 | 0 |
| 12V | 1200V | 200MA | | £6 | 10 | 0 |
| 6V | 500V | 150MA | | £6 | 10 | 0 |
| 24V | 250V | 100MA | New | £2 | 0 | 0 |
| 12V | 300V | 250MA | | £4 | 10 | 0 |
| 12V | 235V | 50MA | | £2 | 15 | 0 |
| 12V | 350V | 50MA | | £2 | 15 | 0 |

# PECIALS for August Only

*ARE OVERSTOCKED, WE NEED THE SPACE. PRICES APPLY ONLY FOR 1 MONTH*

## 100 ASSORTED RESISTERS

well-known makes 50 values.
**8/6** Postage 2/6

## w Electric 24v to 32v Hydraulic Pumps

duty motor develops 1 hp cont intermittent. Ideal motor for oper. power tools off 32V-DC.
**£1/15/-**

## GLISH I.F.F. UNITS

condition V.H.F. TX. RX. 10 valves genemotor and a host of parts. No ts.
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## Steanes P.A. Horn Speakers

Horns. O.P.T.X. 500 & 1000 fitted

| | |
|---|---|
| Condition | £19/10/- |
| Reflex Horns | £22/10/- |

## TRANSCEIVERS

| | |
|---|---|
| No. 11 Less valves & meter | £3/-/- |
| No. 11 Including valves & meter | £4/10/- |
| No. 19 Less valves & meter | £3/-/- |
| No. 19 Including 15 octal valves and 500 micro amp. meter | £5/15/- |

N.S. All these units are in excellent condition. For original use parts or conversion

## New Creed Hi-Speed Relays

Laboratory Standard Instruments. Will operate to 3000 Pulse per minute
**£1/7/6**
BASES 10/- extra

## 522 TRANSCEIVERS

17 valves 100 to 156 Megs Complete with valves.
**£14/10/-**

## CONDENSERS

NEW 100 ASSORTED
Mica. Paper Electrolytics 20 values.
**£1/8/6** Postage 2/6

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24V. 100MA. BRIDGE, ideal for trickle Chargers. Relay operation etc.
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Operate on 3 volts.
Fully adjustable ideal for models, Alarms etc.
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## $2\frac{1}{2}$" Moving Coil Meters

Flush Panel Mount 15 MA & 30 MA
**12/6 ea.**

## 24 to 32v INPUT GENEMOTORS

Fully filtered. 250V 60 MA Output & 6V 2.5 Amp. Secondary.
**£1/17/6**
12V Model as above
**£2/7/6**

Amplification Communication Electronics

# A.C.E. RADIO

PHONE
LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W
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EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY—XW5
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42

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Dual wave, bass & treble boost tuned RF stage 12" speaker.

**£28/17/6**

## 5 VALVE RADIOGRAM CHASSIS

DUAL WAVE 12in SPEAKER

**£18/15/-**

5 valve also available as home constructors Kitset **COMPLETE WITH CIRCUIT £14/15/-**

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3 band, 2 to 6 to 18 megs 160 to 16 metres and broadcast. Exceptional selectivity sensitivity 2 microvolts. **NEW AUSTRALIANS,** listen to European short wave stations.

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6 valve 10 watt **£14/17/6**
6 valve 25 watt **£25/7/6**
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## BATTERY ONLY OPERATION

6 valve 6 volt 10 watt **£18/15/-**
7 valve 12 volt 10 watt **£19/15**
7 valve 12V 25 watt **£24/17/6**

## BATTERY AND A.C. OPERATION

5 valve 10 watt 6V. **£20/15/-**
7 valve 12 watt 12V. **£21/15/-**
7 valve 25 watt 12V. **£29/7/6**

## HI-FI RANGE

MULLARD 5/10

**£34/15/-**

Complete with Jensen twin cone speaker, Ferguson O.P. transformer, 301 & U.L. taps.

**MULLARD 5/20 AS ABOVE**

**£42/15/-**

Tuner & separate control box with mike, pre-amplifier.

**£12 extra**

## THE FINEST SET AT ANY PRICE

CHECK THESE EXTRA FACILITIES

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## DEMONSTRATIONS EVERY SUNDAY 2 to 5 p.m.

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PHONE XW5956

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## THE OUTSTANDING 10-VALVE HI-FI

RADIOGRAM CHASSIS

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**£44/15/-**

Dual wave, 6 valve radiogram chassis includes bass & treble boost, 12" Jensen or Magnavox speaker.

**£23/15/-**

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Formers in cans with special V.H.F.
slugs and winding data for vid
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Video and sound I.F.s ratio detector
traps to A.W.A. circuit specification
aligned . . . . 19
Wired and tested video and soun
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ing valves and circuit. Including
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Also first class technical and align
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$5\frac{1}{2}$ megs. & every $\frac{1}{2}$ me
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Also simplified version
6in C.R.O. P.P. Deflectic

**£44/15/-**

## 4 SPEED PLAYERS

**£11/17/6**

## 4 SPEED CHANGERS

**£16/17/6**

# IR PRESSURE AND THE WEATHER

(Continued from page 19)

W depend for rain on the Low pres- n the South forcing the Antarc- l air up to the continent where lenses.

ummer time the centres of the usually pass to the south some- across the Great Australian It is then that we depend on n Lows like the monsoons to us the rain we need. Some- hese Lows are very great in ex- tending down from Asia right in- N.W. and bringing extensive rains.

look at the maps herewith you tice that on the southern side of a he wind is blowing from the west. eastern side it is southerly, on rthern side it is easterly and on stern edge it is northerly. On the ts" it is on the "half-way" marks speak.

Low pressure system everything ersed because the wind blows in kwise direction. Thus on the rn side the wind is from the east on right round the circle.

## H PRESSURE RIDGE

o happens that, because of Aus- geographical position we lie in ath of part of the sub tropical ressure ridge of the Southern He- ere. The pressure systems move west to east in a continuous sion so that any area usually re- one high pressure system every The system moves from west to the rate of about 17 miles per

k at the map for the 2nd May here. There is a High at the bot- f Western Australia. By the 7th it oved across over N.S.W. On the another High is moving into West- ustralia and a Low or Cyclone is ng a "Tongue" up between the two . There is always a low pressure en two highs.

e black saw toothed line through Low indicates that a "front" of air is on the way to the east. This COLD FRONT.

could have received rain over al Australia and South Australia this LOW if it wasn't for the fact the Highs on either side were too g and pushed the cold moist air into the Antarctic, so that by the May the Low is pushed right out e way and the High is spread out ver the continent.

## SISTENT HIGH

the 23rd little change is noticed. High which should have moved to east still dominates the continent two weak Lows one on either side.

n the 24th these two Lows have also pushed away and the High dominates. The 28th shows the having moved east with another tongue between the eastern High another coming in from the west.

he map for the 29th shows the east- High still in the same position and Low tongue considerably weakened. has persisted right through to the of June where we reach a stage re this High has been hanging around the one place for some three weeks.

This is one of those occasions where the pressure systems do not behave normally and of course bring abnormal weather.

The last map for the 10th of June shows the High still over N.S.W. but a fairly strong Low tongue with two pronounced Cold Fronts is moving from the west. This could bring good rains and indeed to-day's forecast is more hopeful. Whether the Low is strong enough to push the eastern High away only to-morrow can tell. I'll certainly watch that forecast but don't blame me if nothing happens. Just tell me how good I am if rain comes. Publicise my success, that's the way to do it.

The reason why this High has been hanging around New South Wales for so long like an income-tax collector after an unpaid bill, has been explained as follows.

## COOLER AIR

All the air surrounding the continent particularly to the south is much cooler than the air over the land. This cool air has banked up all round the centres of High pressure, forcing its way upwards through the Lows and descending again in the Highs thus creating a cycle of a continually built up pressure in the Highs which is always more powerful than the Lows.

This is the explanation given to me by an authority. Whether it makes sense to the reader is another matter but it sounds feasible if you read it two or three times.

The continuous procession of High pressures across the Australian continent, makes it the most arid of all the continents. Even its shape is unfavourable because, having its greatest length from east to west, the greater portion is exposed to the influence of the High pressure.

We have no extremely high mountain ranges, no large rivers or lakes, no great indentations of the shore line except the Gulf of Carpentaria. Thus most of the land surface except the coastline is more or less isolated from large bodies of water which, by evaporation, influence rainfall.

It is therefore follows that only the narrow coastal belt has any sort of a decent rainfall while the interior is dry and arid.

Sometimes on the coast a High pressure system in summer will bring showery weather there because the south easterly wind, which blows at the "top" end of the High brings moist air in from the sea. It flows across the land to the Great Dividing Range where it is forced to rise, cools and condenses into rain between the coast and the mountains.

There is very little rain on the other side of the range from such a High.

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**Lucas Twin Magnetos**

(New condition)

**Special Price £3/10/-**

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**The performance of the ORTOFON Pick-up Type A is almost identical to that of the ORTOFON Type C advertised by us last month. It is fitted with a Sapphire Stylus and is used with Arm S212 and Transformer. Of identical design but slightly more robust construction, the Type A Head is most suitable for general use.**

With an output comparable to that of the best Crystal Pick-ups (100 mVs), and the excellence of its moving coil design, this Pick-up when used with most good amplifiers gives a standard of performance hitherto unobtainable at such moderate cost.

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Do You Laugh Your Greatest Powers Away?

THOSE STRANGE INNER URGES

You have heard the phrase, "Laugh, clown, laugh." Well, that fits me perfectly. I'd fret, worry and try to reason my way out of difficulties—all to no avail; then I'd have a hunch, a something within that would tell me to do a certain thing. I'd laugh it off with a shrug. I knew too much, I thought, to heed these impressions. Well, it's different now—I've learned to use this inner power and I no longer make the mistakes I did because I do the right thing at the right time.

**This FREE BOOK Will Prove What Your Mind Can Do!**

Here is how I got started right. I had heard about hypnosis revealing past lives. I began to think there must be some inner intelligence with which we were born. In fact, I often heard it said there was; but how could I use it, how could I make it work for me daily? That was my problem. I wanted to learn to direct this inner voice, master it if I could. Finally, I wrote to the Rosicrucians, a world-wide fraternity of progressive men and women, who offered to send me, without obligation, a free book entitled "The Mastery of Life."

That book opened a new world to me. I advise *you* to write to-day and ask for your copy. *It will prove to you* what your mind can demonstrate. Don't go through life laughing your mental powers away. Use the coupon below or write: Scribe D.N.X.,

**USE THIS GIFT COUPON**

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Please send free copy of *The Mastery of Life*, which I shall read as directed.

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City .............................. State ..............

The **ROSICRUCIANS** (AMORC), Box 3988, G.P.O., Sydney, Austra

# T'S BUY AN ARGUMENT

(Continued from Page 83)

light shining on to the tube duced in quantity as it passes he filter glass. It is further reen reflected back so that, withcture, the tube face appears nuch darker than without the s.

this the ocular and lighting eady mentioned and it becomes to watch a television program ly while other members of the read or knit in the same they can concentrate on such ks.

where M.G. enters his protest. gests that it is wrong to watch under these conditions, because es eyestrain and also nervous reason of the efforts necessary ntrate on the picture, in comwith other visible distractions. vays, I think, he is overstating

eaks of ambient light "shining eyes."

## IN THE EYES

ay have used the phrase quite y but it immediately suggests n where the source of ambient n the field of vision and theretruth, "shining into the eyes." I heartily agree, would be no sirable than trying to read with on the table directly in line book. Or yet, reading flat back in bed, with only a ceiling tched on.

one speaks about viewing telemoderate ambient light, it pre that the source of light is outfield of view—either a lamp n another part of the room, or erhead, or else left on in an adoom. It is assumed also that re no highly reflective surfaces to the set, which might assume racter of a light source. peak of light "shining into the nder such conditions is an exon in terminology, to say the very

## DISTRACTIONS

Then M.G. seems to be very concerned about the distracting influence of objects or people in the room, revealed by such subdued lighting.

If one's job were to concentrate on the television image, to the exclusion of all else, then I would agree. If it was a radar screen and the viewer was watching for some elusive "blip," then neardarkness might be a prerequisite for concentration.

But television isn't a job, it's an entertainment. If the entertainment value is high, concentration will not be a problem. There won't be any nervous strain from trying not to look at something else!

If the interest in the picture is low or intermittent, then it is a good thing to let the eyes stray away from it to other people in the room. Unless I'm much mistaken, the very act of moving the eyes from a fixed position will provide an excellent insurance against strain.

There are plenty of T.V. shows which lend themselves to a certain amount of back-chat between the audience — for which I personally am duly thankful. While I like to be quiet in the right places, and other people to be likewise, I have no desire to spend all my evenings henceforth in a darkened room, gazing in stony silence at a glowing glass.

They're my ideas, anyway.

If they need support, may I quote from a set of rules for comfortable television viewing, which have just been issued by the British Institute of Ophthalmology. They were brought to notice by Mr. F. D. Wallace, sales manager for E.M.I. Television in Australia.

They are quoted in the panel under the appropriate heading. Maybe you agree, maybe you don't. I wonder what M.G. will say?

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AMATEUR TYPE CRYSTALS 3.5 AND 7 MC BAND
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£3/-/- each. Plus 12½% Sales Tax. REGRINDS £1/10/-
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We would be happy to advise and quote you as to the most suitable crystal for your particular application either in the pressure or vacuum type holder.
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## NEW MICRO-AMMETERS

NEW PATON MICRO-AMMETERS, 0-500, M.A 1¾in diameter Flush mounting

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Post and Packing 2/6.

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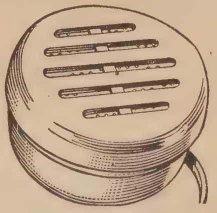
WESTINGHOUSE 1M.A METER RECTIFIER.
FULL WAVE. NEW 15/-.



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**Install it anywhere, in the sick-room, work shop, garage or any room in the house. Just connect across voice coil of the existing speaker. The "PILLO-FONE" IS THE MOST CONVENIENT LITTLE UNIT YET DEVISED**

**3½in Diameter by 1¾in deep POST FREE**

**22/6**

"Mercury' American Made.) These relay counters register from 0 to 99,999 can be supplied with 250-ohm coil 24v D.C. operation

**25/-**

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## NEW AMERICAN BOX KITES

**These kites are constructed of Silk with Meta Frame.**

**SIZE 15in square x 3ft long. Originally used for Aerials for Lifeboat Transmitters.**

**30/-** **Post 2/-**

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**24 to 32 Volt D.C., Input, Output, 240 Volt 5 Cycles at 150 Watts. Suitable for Tape Recorders Radiograms, Amplifiers, etc.**

**£16/15/- F.O.R.**

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These units cover a frequency of 2 to 8 mc and contain 15-6.3v valve, including 1-807 2-6V6S, 6-6K7G, 2-6K8G, 6B8S ETC, 0-1MA Meter 4-GANG cond H.F Unit ETC.

**£6/15/**
F.O.R

12v Gene Motor for above, **£3/5/-**
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**20/- will purchase anyone of the following valve Specials**

| | | | |
|---|---|---|---|
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| 3 | IP5 | 5 | 6SH7 |
| 3 | IQ5 | 6 | 6AC7 |
| 5 | IC7 | 4 | 6J7G |
| 10 | IKS | 4 | KTW62/6U7 |
| 5 | 954 | 4 | 12A6 |
| 5 | EF50 | 2 | 6X5GT |
| 4 | 6C8G | 8 | EA50 |
| 3 | 6SA7 | 5 | 6K7G |

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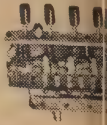

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American selsyn-motors 50 volt mitter or slave.

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Heavy duty 12v Genemot ideal for public address tems etc Two separate puts—270v at 110mA 550 at 55mA **£4/-/-** F

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332 PARRAMATTA ROAD, STANMORE, N.S.W. PHONE LM7398
479 PARRAMATTA ROAD LEICHHARDT, N.S.W. PHONE LM3610
640 KING STREET, ST. PETERS, N.S.W. PHONE LA6087

# W VALVES AT REDUCED PRICES

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|---|---|---|---|---|---|---|---|
| | 7/6 | 6B8 (metal) | 10/6 | 6J6 | 15/ | KTW62/6U7 | 6/6 |
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| | 5/- | 6H6 | 3/- | 6SH7GT | 5/6 | 7193 | 3/6 |
| | 7/6 | 6H6GT | 3/- | 6L6 (metal) | 20 | 954 | 4/5 |
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| | 9/6 | 6K8G | 10/6 | EL33 | 12/6 | 866/866A | 15/- |
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### NEW POWER RANSFORMERS

prim.: 240v with 230v tapping. 85 x 285 with 6.3v filament

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per-mag speaker by well-known facturer. 10T. CT. or 5000 Trans- er . . . . . . . . . . . . **£2/17/6**

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Supplied with 5T, 7T, or 10T, Transformer.

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6in x 9in Oval Dynamic Speakers with 5T or 7T Transformer.

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New Coils and Intermediate Transformers to suit all valves.

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Box of 10 new Carbon Potentiometers.

Containing .5 and .1 switch pots., long spindle, .5 and .1 standard and miniature pots, long spindle and other mixed sizes, short spindle.

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Boxes of 100 new mica paper and electrolytic condensers in values ranging from 50pf. mica to .5 400v paper. Values include .0001, .00025, .00075, .01, .02, .05, .1; Also 500 mfd/12v, 10 mfd/40v, 8 mfd/525v, 16 mfd/350v, electrolytics

**30/-** per 100.

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| ½ Meg. Miniature Switch Pots, d/p Switch Long Spindle | 5/6 |
| 1 Miniature Long Spindle | 3/6 |
| Standard ½ or 1 meg. switch pots., long spindle d/p switch | 5/6 |
| ½ meg or 2ST, ohms short spindle switch pots | 2/6 |
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All plus postage.

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These English Clocks — which are new in original cartons—are panel mounting and are ideal for cars, etc. Luminous dials.

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# METROPOLITAN RADIO SUPPLIES

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79 PARRAMATTA ROAD, LEICHHARDT, N.S.W. PHONE LM3610
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Packing and postage (all States), 4/.

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Useful for TV masts, tent poles, curtain rods, etc. In 3ft 6in lengths; diameter 7/8in, **3/6 ea.**

Freight forward rail.

**For many jobs around home.**

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Ideal for watching football matches.

Price: 8/6. Prisms, 25/-.

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**2/6 to 12/6.**

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Don't pay high prices for replacements
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| 12A6 | 7/11 |
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| 6U7G | 6/9 |
| 6F8G | 12/6 |
| 6C8G | 12/6 |
| 6D6 | 12/6 |
| 6E5 | 7/6 |
| 6H6GT | 3/11 |
| 6J5 | 12/6 |
| 6K7 | 6/11 |
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| 6AJ5 | 12/6 |
| 6N7 | 9/11 |
| 6SA7GT/G | 8/11 |
| 6SF5 | 7/6 |
| 6SH7 | 7/6 |
| 6SS7 | 7/11 |
| 6SJ7GT | 12/6 |
| 6J7GT | 7/11 |
| EF50 | 3/6 |
| VR53 | |
| VR100 | |
| VR105 | |
| VR150 | |
| VR78 | |
| VR65A | |
| 7A6 | |
| 7A8 | |
| 7C5 | |
| 7C7 | |
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| 7193 | |
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## Here Are Many Fine Things In Radio, And At Bargain Prices

**Here Are Many Fine Things In Radio, And At Bargain Prices.**

A.W.A. RECEIVER, TYPE 2—1C6770. 5 Bands: 200 Kcs—30 Mcs 230V AC input, **£50.**

A.W.A. RECEIVER. 332C6940, 3 Bands: 1.4 to 3 Mcs. 2.5 to 9 Mcs, 7.5 to 23.5 Mcs AC 230-240 volt input; 8 Circuits: 1 Beat Oscillator; 7 Valves: Low Impedance Output. **£45**

AWA TELERADIO-TRANSMITTER 3BZ. 12V DC Working operation instructions in set. 2.5 to 5 Mcs. Double **£35.**

WALKIE-TALKIE SETS SET No. 88. 14 Valves Crystal-tuned, 4 positions: 38.01. 38.6, 39.5 39.7 Mcs Battery Input 1.5V for heating. 90-135V for HT. Hand-pressed Send-Receive Switch; Headphones a Microphone connected with one 3-pin plug. Price, **£22/10/.**

SET No. 108 Mk III Transceiver, 2.5 to 3.5 Mcs, operating instru tions in set. Mike—No. 3 Headphones, Low Impedance. **£15.**

SET No. 128 Transceiver for Battery or Vibrator Pack. Diagra in set. Range, 2.5 to 4.5 Mcs. Working for Master Oscillator on crystals. **£15.**

SET No. 46. Crystal-tuned, 3 positions. Rec. crystal must be 1550 higher or lower (I.F 1550 Kc) as the Transmitter crystal. Coil ran 3.6 to 4.3 Mcs (coil is in set). Set range, 2.5 to 7.5 Mcs. **£25.**

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We can supply this (Melbourne branch only) in a variety of sizes. This strong metal alloy hollow tubing can be used for many purposes, such as tent poles, rails, and as an aid for interior decoration. Details:

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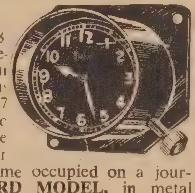
| 1 3/8in | 3/32in | 3/ |
| 1 3/8in | 1/32in | 2 |
| 1½in | 1/32in | 2/ |
| ¾in | 9/32in | 2/ |
| 1 1/8in | 1/32in | 1/9 |
| 1in | 3/16in | 1/9 |
| 9/16in | 1/8in | 1/6 |
| 9/16in | 1/32in | 1/3 |
| 7/16in | 1/16in | 1/ |
| ¼in | 1/32in | 6d |
| 5/32in | 1/32in | 5d |

### *MOTORISTS!*
### *DASHBOARD CLOCKS*



**SMITHS CLOCK**, with 8 day Ancre movement: 12-hour dial, luminous hands and dial; 7 jewels Also fitted with Elapse Time Hands for calculation of time occupied on a journey. **STANDARD MODEL,** in metal case: dial, 1 7/8in. dia., 1 7/8in deep. **£5.**

Packing and reg. post, 3/6; I/state, 5/.

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**Build your Battery Chargers with these.**

6 volt 2 amp. .. .. .. .. ..
6 volt 3 amp. .. .. .. .. ..
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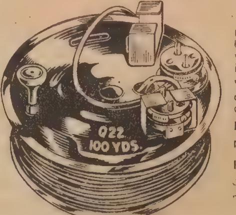
6 volt 5 amp. .. .. .. .. ..
6 volt 10 amp. .. .. .. ..
12 volt 2 amp. .. .. .. .. ..
12 volt 3 amp. .. .. .. .. ..
12 volt 5 amp. .. .. .. .. ..
48 volt 2 amp. .. .. .. .. ..

## Look at these Bargains

**Headphones:** High Impedance, **32/6;** Low Impedance. **17/6.** Packing and postage 3/. Crystal Sets, **49/6.** Packing and delivery to rail, 5/. Variable condensers for crystal sets, **7/6.** Call and select Crystal set cabinets, **7/6.** Call and see. Germanium Diodes for crystal sets. **7/6** (post free). Book on Crystal Set Construction, **1/6.** Postage, 4d. No 3 Hand Microphone, **17/6.** Packing and postage. 3/ Parabolic Mirrors. 3½in diameter, **15/.** Packing and postage. 4/ These also are worth inspection Gear Reduction Boxes, worm and wheel 50-1 reduction. **35/.** Morse Buzzers. **10/6 each.**

## Q22 TWIN WIRE,
### 100yds on Steel Drum



Ideal for telephones bells, low-voltage lighting, etc

Waterproofed for outdoor use

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**Mention State from which letter sent and kindly include 6d f postage.**

# NSWERS TO CORRESPONDENTS

**pane, Q.)** complains that he posted a ır query service in January last and y has yet appeared in these columns. his query which concerns the con- headphones to a push-pull amplifier.

regret that you have been incon- J.B., and we have done our best letter to which you refer. Unfor- cannot remember handling it (our nto hundreds of letters a week) and ook—wherein is recorded all incoming g mail—contains no reference to it. umstances we can only assume that was never received or that it has somewhere in our own system. It nfortunate that you did not give us ostal address on your last letter, J.B., could have expedited matters with a . In the absence of this we can only quickly as possible through these

g your query we would make the points: Although it is permissible to adphones to the plate circuit of the e through a capacitor, this arrange- ot without its disadvantages. One is gnal and hum level at this point are and it is often difficult to control without reducing it to a value com- ith the hum level. These remarks able equally to single-ended or push- s, the latter using two coupling capaci- ou suggest. We are not quite sure mean by your reference to "loading s like D.C." or to a power trans- oading a power rectifier valve," but o objection to the method of connec- suggest, apart from the general ones ier. In spite of your experience, we d that the voice coil connection has of advantages. One is the absence d D.C. voltages from the phone circuit ther is a more reasonable signal level usually adequate in the phones when er is operating at about normal room This applies to both high and low phones even when operating on the oltage available from a 2- or 3-ohm . With a 15-ohm circuit the position much more favourable. If the speaker quired it can be replaced with a 15- tor. The fact that your phones will in this position suggests that they may and it would be advisable to check her pair if possible.

**Moree, N.S.W.)** wishes to make the harger and would like the name of a h is able to supply a complete kit of

are not aware of any specific firm making the complete kit of parts avail- owever, we feel that several of our s who normally handle kit sets should position to supply the necessary parts a charger.

**Newborough, Vic.)** asks about the pos converting an English television receiver e in this country.

would be possible to convert the re- operate here but it is unlikely to be a proposition, unless you can tackle the self. Fundamental alterations have to be almost every part (of the receiver and that the cost would be a good deal more figure you have quoted. Then there uestion of transport costs. You would do much better if the receiver were England and the money put toward a eiver here.

**(Maitland, N.S.W.)** is interested to know have ever described a frequency meter for use in a "ham" installation.

es, R.C., such an instrument was des- n the August, 1949, issue of "Radio and " and a copy of the circuit and other s can be had through our query service ormal way.

**(Ferryden Park, S.A.)** is having trouble crystal set which receives the local stations ell but is subject to interference from a relaying the A.B.C.'s overseas service at He wants to know if there is any way g this.

his sounds suspiciously like another of ases where a crystal set is responding to rful short-wave transmitter, in this case one of the Radio Australia outlets and ake part of their program from the A.B.C., of the A.B.C.'s own VL transmitters. ubt whether very much can be done about gh the first thing to determine would be act nature of the transmission and the cy involved. It might then be possible ce the signal strength by means of a trap tuned to the offending station. This is y a parallel tuned circuit placed in series he aerial lead and which offers a very npedance to the frequency to which it is To receive the signals at full strength ng that they are from a short-wave trans- it would be necessary to wind a coil of tuning to the particular frequency and would be an interesting experiment. One of our coil data pamphlets available through our postal service would provide some basic data on which experiments could be based.

**A.K.S. (Concord, N.S.W.)** is anxious to obtain some data on speaker enclosures which will improve the performance of his speaker which is now mounted in a "butter box."

A. Almost anything will probably sound better than a butter box, A.K.S., even a plain flat baffle, and almost any vented enclosure would effect a considerable improvement. A series of articles on vented enclosures appeared in the September, October, and November, 1956, issues of "Radio, TV and Hobbies" and a few copies of these issues are still available. The price is 2/ per copy. Alternatively you may care to try the scheme suggested for our latest radiogram.

**J.M. (Bondi, N.S.W.)** writes to say that he has a 4-valve commercial portable receiver and that he wishes to operate this from the mains. J.M. has obtained the circuit of a power supply for the Carry Set and wonders whether it would suit his requirements.

A. Provided the valves used in the commercial portable are similar to those used in the Carry Set which were standard 7-pin miniature valves, the difference in current drains is not likely to be significant and the Carry Set power supply should serve the purpose.

However, we recommend the power supply for portables which was featured in the October, 1956, issue. This supply has a more efficient filter system and would be essential with larger variety of portable, where the speaker would have a better bass response on account of the increase in cone area and baffling.

**C.T. (Northcote, Vic.)** sends a query about the assembly of the recently described boffle unit and also makes some suggestions for the description of a short-wave converter.

A. We are not quite sure that we have understood your query correctly, C.T., but we assume that you are referring to the order in which the boffle plates are fitted. If so, your interpretation of the article is correct. Many thanks for your suggestion regarding a short-wave converter and we will keep this idea in mind. In the meantime the circuit of the Two Band Converter of July, 1955, may serve as a basis for experiment.

**G.K.H. (Goolamba, Vic.)** is keen to build a communications receiver designed around modern miniature valves and wants to know if we plan to describe anything along these lines in the near future. He is also worried about the performance of certain ceramic capacitors when used in tuned circuits.

A. We have no immediate plans for a receiver along the lines you mention, G.K.H., although we will no doubt describe something like this eventually. The capacitors you are using are not really intended for use in tuned circuits, being designed mainly to provide as much capacitance as possible with a minimum inductance. Their power factor may well be very poor compared to other types, though they are still perfectly satisfactory in their intended application. In fact they are often the only answer to the difficult by-pass problems encountered at high frequencies. We have in mind to describe alternative forms of sweep generator as soon as time permits, though the present design works so well that we will probably rest on our laurels for a few months.

**A.E.P. (Centennial Park, S.A.)** is anxious to build a battery charger and has partly dismantled an old transformer which he wishes to rewind for the job. He wants to know if we can give him details of the transformer windings.

A. Sorry, A.E.P., but the design of special transformers is outside the scope of our service, particularly as we have no details of the transformer you are using. It is a pity that you have already dismantled the transformer, since it is possible to establish the turns-per-volt figure when a winding is removed. The usual procedure is to remove one or all of the low voltage windings, being careful to count the turns on each. From this the turns-per-volt figure can be determined and a new winding substituted based on this figure. A common one is five turns per volt. For a battery charger using a copper-oxide rectifier the transformer will need to deliver about five volts more than the nominal battery voltage in each case. Thus a six-volt battery will need an 11-volt winding, a 12-volt battery a 17-volt winding, and so on. The data for a 230-volt transformer can be scaled up for 240 volts on a simple proportionate basis, though the difference in practice would be very slight and hardly worth considering.

**B.W. (Hamilton, Vic.)** has built the transistor/crystal set described recently with excellent results but he would now like to experiment with modifications.

A. We are very pleased to learn that you have had reception up to 300 miles. Although the set has a much higher gain than a normal crystal set, we would not expect such good results. You can increase the selectivity, or ability of the set to sort out stations, by tapping the aerial nearer the earth end of the coil. Alternatively, you could employ two tuned circuits inductively coupled, as in the "Twin-Tune" Crystal Set described in the April, 1951, issue. Both methods will result in reduced volume but since you seem to have plenty, this may not be too serious. A small variable capacitor (say, 50 pF max.), in parallel with the main tuning capacitor will give bandspread but we do not think that this would be an advantage since it would not improve the ability of the set to separate stations and the dial is easy enough to tune with the full-size capacitor. There would be no advantage in using a potentiometer in place of the .1 meg. resistor and, in fact, damage could be done to the transistor with certain settings of the potentiometer

## The Radio, Television and Hobbies Query Service

All queries concerning our designs, to which a POSTAL REPLY is required must be accompanied by a postal note or stamps to the value of TWO SHILLINGS.

For the same fee, we will give advice by mail on radio matters, provided the information can be drawn from general knowledge. UNDER NO CIRCUMSTANCES, however, can we undertake to answer problems involving special research, modification to commercial equipment or the preparation of special circuits.

Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

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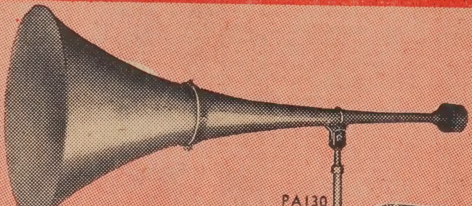
PA138

Standard reflex horn speaker for medium distance projection of speech and incidental music.

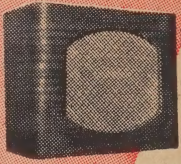


PA130

Standard exponential horn speaker for public address where distance projection of speech and incidental music is required.

PA

Attractive moulded cabinet with 7" speaker and 600 ohm transformer. Suitable wall or desk mountin



Polished timber cabinet for wall or table mounting with 12" cone speaker and 600 ohm line transformer.

PA150/W

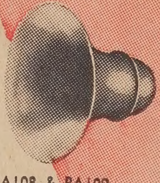
Moulded wal speaker similar above. These m are also avail with 600 stepped faders.

RESLO

DRIVE UNITS:

SU10 & SU12

Exclusive features are the self-locating diaphragm and the concentrically interlocked magnet which together produce an undisplaceable mechanical assembly, proof against decentering.



PA108 & PA109

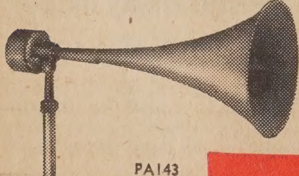
These flare baffles are for use with 7in and 12in permanent magnet cone speaker units and provide high conversion efficiency.

PA118

Pendant type, ceiling suspension, 360° diffusion speaker suitable for distribution of voice and music.

PA73

Ivory timber cabinet 7in speaker for applica where a bi - directi characteristic is desired.



PA143

Short exponential horn speaker for distance projection of speech only.

PA177

Flush, ceiling mount 360° diffusion reproducer with 7" cone speaker. Can be colour matched to suit any background.

PA

Surface mount repro cer similar to PA7 for use where flush ting is not practica

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LEADING WHOLESALERS.

## DING OUR
## ch TV
## EIVER

ntinued from Page 72)

s, knowing that most modern
stand plenty of voltage with-
s. Similarly, in three import-
ons in the circuit, we used
)47mfd tubulars, with a hint
her voltage rating would be a

ters have turned out, it is
ble to obtain mica capacitors
critical positions, carrying a
1,000 volts working and they
suitably marked on the cir-

e special case is the 110pf
connecting to the 6AX4-GT.
olt capacitor could be used in
on with reasonable safety but
possible to obtain a mica or
type with a rating of 1,500
etter.

### VOLTAGE TYPES

three tubular capacitors men-
rlier it is now possible to
500-volt types. For details of
citors, see the Trade Review
elsewhere in the issue.

other item, which warrants
mment, is the Contrast control
eter.

ntrol in the original receiver
l-size carbon type, with an ele-
ed fairly conservatively at 0.5
reckoned that this would per-
rent of just over 30 milliamps
ll or part of the element, with-
oad.

ctice, the original potentiometer
use.

er, we have heard of troubles
r smaller carbon potentiometers
e allegedly not large enough to
n equivalent rating.

lingly, some constructors have
re-wound potentiometers, some
cess, others with apparent high
y degeneration, due to cathode
ductance. At the time of writ-
have not been able to track
e full story of the wire-wound
t it would appear that they do
dely in inductive qualities.

ve discovered, however, that the
r potentiometer we used has
roduction, due to some current
of element material, and the
difficulties are largely due to the
there are now none of the early
ft.

### R VALUE POT.

uld be pointed out that a 200-
ntrast control will be adequate
t high signal areas, and a carbon
this order will carry half again
n current for a given size and
as a 500-ohm potentiometer.

**the meantime, Messrs. Wm. J.
llan have suggested that the
vay out of the difficulty is to
two-gang 1,000-ohm carbon
with the two sections wired in
el. This will give an effective
element dissipation of 1 watt
a current-carrying capacity of
over 40 milliamps.**

**now one final but important mat-
t of possible interference from** your TV set to nearby broadcast receivers.

The usual source of interference, which is not peculiar to home-built sets, by the way, is radiation from the line output circuits, notably the yoke and the leads thereto. It may be troublesome in areas where broadcast signals are weak and where the abovementioned components are more than normally exposed.

The cure is very simple and is identical with that adopted by most commercial manufacturers: Simply line the sides, top and rear of the cabinet with thin aluminium foil, attached with drawing pins or, if you like, glued to the wood. Copper gauze may also do the trick. Simply bond the shielding to the chassis and earth the whole lot, directly **or via the power socket.**

# THE R., T.V. & H. CROSSWORD No. 38

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| 1 | | 2 | 3 | 4 | 5 | | 6 | 7 | 8 | 9 | ■ | ■ |
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| 39 | | | | | ■ | | ■ | ■ | 40 | | | |

### ACROSS

1. Mutual action between components.
10. Made use of.
11. Gently flowing.
13. Changes frequency balance in sound reproduction (2 words).
15. Report of recent happenings.
16. Letting.
18. Chemical symbol for tellurium.
19. Covered by a thick mist.
21. Prefix meaning life.
23. State of being mentally deficient.
24. Chemical symbol of copper.
25. Composition from different authors.
26. Man's name.
27. Prefix meaning three.
28. Spectre.
30. After the proper time.
33. To push lightly.
35. Reprieve.
38. Flys high.
39. A colour.
40. Slender round bars.

### DOWN

1. Component of a vibrator.
2. Inductors used in resonant circuit (2 words).
3. Point of a compass.
4. Conversion of AC into DC.
5. Fuss.
6. Tiny child.
7. Affix meaning more.
8. Form of oxygen to combat odours.
9. River in Egypt.
12. In the form of an aeriform fluid.
14. Wall of scantling filled with bricks.
17. Point where current or voltage is at a minimum.
18. American colloquialism for business magnate.
20. A barbarian.
22. Water turned solid.
26. Limited (abbrev.)
29. Prefix meaning over, above.
31. Semi-circular recess in a church, etc.
32. Greek letter.
34. Valve element.
36. Organ of hearing.
37. Historic period of time.

***Solution and further crossword next month***

### *Last month's solution*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| E | ■ | H | ■ | L | ■ | I | O | D | I | N | E | ■ |
| L | ■ | E | S | E | ■ | A | N | O | D | Y | N | E |
| F | O | O | T | C | A | N | D | L | E | ■ | E | ■ |
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| A | ■ | T | I | R | E | S | ■ | S | P | E | A | K |
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| A | ■ | T | ■ | M | O | S | Q | U | I | T | O | ■ |
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| I | ■ | ■ | S | L | I | D | E | ■ | ■ | N | ■ | I |
| T | A | R | S | U | S | ■ | L | U | G | G | E | D |
| Y | ■ | ■ | E | X | ■ | ■ | C | ■ | U | ■ | ■ | E |
| ■ | M | I | X | ■ | ■ | S | H | U | N | T | ■ | S |

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**FOR SALE:** Back issues of R. and H., 3/ per copy incl. post. **T. Weir, O'Connor St., Haberfield, N.S.W. UA2569.**

**FOR SALE:** Sell outright or separate, or exchange for good communication receiver, MN26C converted 240V, 5in Loran Cro Indicator Unit, BC453 converted 6V vibrator. Supply —all good order—offers to 14th. **G. Billett, 2GF, Grafton.**

**FOR SALE:** Unused recording equipment; Royce 17in turntable with motor and transformer; Royce Senior overhead traverser with screws; two 12in tables with motors and pulleys. Best offer. Write **15 Wellesley Rd., Hawthorn, Vic.**

**FOR SALE:** 3 Leatherette portable cabinets, 9 sets Stromberg Carlson 2 and 3 Gang Condensers, 2 Efco Dials, 1 12 volt Fan, all above new. 7 only Battery radio chassis with speakers, all with valves and working less cabinets, Radiola, STC, etc. 1 model 222 Calstan AC/DC valve tester with very little use, also quantity of small radio parts, etc. Must sell. Best offer. Freight paid. All sold separate if required. **Allan W. Davis, Bellbrook, via Kempsey, 2C.**

**FOR SALE:** Hi-Fi system. M.B.H. pick-up; Byers turntable; 17W U.L. amplifier; 2 speakers with crossover network. **FM6490, Sydney.**

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**FOR SALE:** Playmaster No. 5; Control Unit No. 6; Goldring VR Pick-up Rolo 120X Philips 3-speed turntable Radio-Tuning unit £40. **UJ3376.**

**FOR SALE:** Radio and Electrical business, 5-year lease, showing good profits, £800 approx. Walk in, walk out. Very suitable for young man wanting a good start. Must sell, ill health **Reply c/- "Radio and Hobbies" Advertising.**

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**FOR SALE: Leak TL10** amplifier and point 1 control unit, brand new. **Phone Sydney. XL3222.**

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**SELL:** Bendix compass receiver 240 exc. condition, £35. **Ring XM769**

**SELL:** 2 No. 11a, complete with tubes plugs and cables, both power su each. **J. D. Purdow, Woombye, Qld.**

**SELL:** Tape recorder, American M volt, complete with 3100ft tape a phone, excellent condition, £60. M **nell, UY3400.**

**SELL:** Complete A.R.C. radio cours offer. Complete B.I.E.T. engine (P.M.G.) all textbooks, £15 or offer. ceiver 3-30 Mc, 9-valve bandspread, £1 **G. R. Hannan, P.O., Toolamba, Vic.**

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**KENNETH MORAN:** You did not address with your order. **Electro Co., Electronics Publications (Aust.).**

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